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25 October 1982

USSR REPORT
ELECTRONICS AND ELECTRICAL ENGINEERING

No. 95

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UDC 621.3.032

DETERMINATION OF NOMINAL POWER TRANSFER RATIO OF PASSIVE SURFACE-ACOUSTIC-WAVE DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 27 Jan 81) pp 3-8

TIMOSHENKO, A. N., PALAMARCHUK, A. A. and SEMENKO, A. I.

[Abstract] An approximate method of calculating the nominal power transfer ratio of passive SAW devices is proposed, and demonstrated on interdigital transducers of this kind. It is based on power relations in the receiver mode and in the radiator mode, assuming negligible reactances in the former and a harmonic incident wave with linear front. A real transducer pair is represented by two parallel equivalent four-pole networks coupled through an energy transmitting acoustic waveguide. The actual power transfer ratio differs from the nominal one by accounting for a net nonuniformity of the amplitude-frequency characteristic caused by reradiation within the transducer pair even in the absence of losses and matching elements, this nonuniformity being averaged over one frequency period in the nominal power transfer ratio. Figures 4; references 17: 9 Russian, 8 Western.
[276-2415]

UDC 621.373.12.001

SURFACE-ACOUSTIC-WAVE DEVICES IN FREQUENCY STABILIZATION SYSTEMS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 27 Jan 81) pp 68-69

LUTSYUK, L. N., PALAMARCHUK, A. A. and SEMENKO, A. I.

[Abstract] A surface-acoustic-wave delay line which with a phase inverter in series forms the feedback circuit of an amplifier operating as oscillator consists of two interdigital transducers, a planar one on the input side and a multisegmental one on the output side, on a substrate of piezoelectric material.

The feedback circuit must be designed so as to satisfy the condition of phase balance within a given frequency interval and to ensure the necessary gain for excitation at given frequencies within this interval. A delay line on a plate of Y-cut LiNbO_3 with an 18-prong input transducer and a 24-prong output transducer (acoustic synchronism at 70 MHz) was tested in an oscillator for frequency stability over the temperature range from -40 to $+50^\circ\text{C}$. The frequency instability did not exceed $8 \cdot 10^{-3}\%$ over this range and the frequency drift did not exceed $6 \cdot 10^{-4}\%$ at any temperature within $\pm 2^\circ\text{C}$, with the delay line in a thermostat. Such a performance, combined with easy matching of transducers and amplifier as well as with the high Q and small size, make SAW oscillators very suitable where frequency stabilization above 40 MHz is required. Figures 1; references: 2 Western.

[276-2415]

UDC 621.391.26

SPACE SELECTION OF SIGNAL AND NOISE SOURCES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 28 Apr 81) pp 729-736

KREMER, I. Ya. and PETROV, V. M.

[Abstract] The output signal-to-noise ratio is analyzed in the case of space-time processing in radar systems of signals with spherical wavefronts. These are coherent multiposition systems, both with respect to reception and to radiation. Interior noise and correlated exterior interference are present in the form of stationary Gaussian noise with a derivative spectrum. The dependence of the signal-to-noise ratio on the spatial autocorrelated function of the signal is established. On this basis the possibilities are investigated of an improvement in suppression of the exterior interference because of a rational choice of the arrangement of the receiving points and use of multifrequency radiation. An analysis is made of: 1) Space selection and suppression of exterior interference; and 2) The possibility of a reduction of the level of the side lobes of the spatial autocorrelation functions of a received signal. The analysis shows that in the radar systems described above, the degree of suppression of exterior active interference because of space selection depends on the level of the side lobes of the spatial autocorrelation function of the signal received with respect to distance and direction. A method is considered for increasing the output signal-to-interference ratio by means of a choice of the optimum geometry of the system. Figures 2; tables 1; references: 5 Russian. [300-6415]

UDC 621.391.26

RANDOM SPACING OF RECEIVER AND TRANSMITTER POINTS IN COHERENT MULTIPOSITIONAL RADAR SYSTEM

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 62 (manuscript received 24 Nov 80, after revision 8 Jun 81) pp 19-23

PETROV, V. M.

[Abstract] The feasibility of reducing the number of elements in an antenna system necessary for processing signals with spherical wave fronts, by randomly uniform spacing of not only receiver points but also transmitter points, is

examined in the case of a coherent multipositional radar without energy focusing which scans space isochronously with M transmitters and K receivers in one plane XOY within a radius $L/2$. First the space-time autocorrelation function is calculated for two signals originating from different transmitters without intersecting in time so that they do not arrive at any one receiver simultaneously. Then the two space (distance and direction) autocorrelation functions in the Fresnel region are calculated for transmitted and received signals. The side lobes of these two autocorrelation functions are estimated and the probability of exceeding their allowable level is calculated for the case of signals coming to receivers from the far region, assuming a Rayleigh distribution of side lobe levels and using the Laplace asymptotic approximation. Supported by a numerical example, this analysis demonstrates that, while N receiver points are required for not exceeding the allowable side lobe level of both autocorrelation functions in a coherent radar system operating in the receiver mode alone, only $M+K \approx \sqrt{N}$ transmitter and receiver points are needed for this in a dual-mode system. Figures 3; references 6: 5 Russian, 1 non-Russian.
[276-2415]

UDC 621.396.22.019.4

INTERFERENCE IMMUNITY OF OPTIMUM TRACKING DEMODULATORS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 22 May 81) pp 10-16

URYADNIKOV, Yu. F. and VASIL'YEV, N. A.

[Abstract] Interference immunity of optimum discrete tracking demodulators with phase or frequency locking, for space communication systems, is evaluated on the basis of the analytical theory of linear filtration. The structure of such demodulator includes a pulse-type phase detector, a clamping circuit, two low-pass filters, and a controlled oscillator. An additive mixture of interference signal $n(t_k)$ and useful signal $s(t, \mu_k(\lambda, t))$ ($\mu_k(\lambda, t)$ - discrete informative modulated signal parameter, $\lambda(t)$ - transmitted message is assumed to appear at the input of a demodulator with a signal-to-noise ratio which allows linearization, plain or statistical, of the discriminator characteristic. The equation of optimum filtration is solved for minimum mean-square demodulation error $\sigma_{\lambda, \min}^2$, with aid of Z-transformation and the Gram-Schmidt method for sequences of linearly independent fractional-rational functions. The results reveal the interpolation capability of such a demodulator and its better interference immunity than that of a continuous tracking demodulator, the error increasing appreciably with decreasing discretization frequency. Figures 4; references: 10 Russian.
[280-2415]

'ORBITA-RV' SATELLITE COMMUNICATION SYSTEM FOR TRANSMISSION OF SOUND BROADCASTING PROGRAMS AND NEWSPAPER COLUMNS

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 (manuscript received 11 Feb 82)
pp 5-8

KANTOR, L. Ya. and CHEKHOVSKIY, Ye. Ya.

[Abstract] The "Orbita-RV" satellite communication system is equipped for broadcasting sound programs from a central operating room on earth through a ground transmitter station simultaneously to several reception zones, and for broadcasting columns of the "Pravda" newspaper in the same manner. Digital signal transmission with time division of channels has been selected as the most advantageous mode of operation, facilitating transmission of 25 sound programs simultaneously or high-speed transmission of newspaper columns in 50% of satellite relay operating time. The other 50% is assigned for voice communication over a multiple-access telephone system. Major components of the broadcasting system include service equipment, remote-control equipment, and ground links. Figures 1; tables 1; references: 3 Russian.
[279-2415]

COMMUTATION CONTROL IN ADAPTIVE SYSTEMS OF MOVING TARGET INDICATOR SYSTEM

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 16 Sep 30) pp 836-839

ABRAMOVICH, Yu. I., DANILOV, B. G. and MIKHAYLYUKOV, V. N.

[Abstract] The present work investigates the effectiveness of commutation control of the adaptive filters of moving target indicator systems (MTIS). Processing of a (N-1)-pulse packet is studied, the weight optimum processing of which ensures a minimum value of the noise power in the "protected" period of repetition. Data shown in figures 1, 2, and 3 of the work illustrate the results of optimization of the commutation filter of a MTIS (N=11). The results obtained indicate the advisability of using commutation methods of alignment of adaptive systems of MTIS. Figures 3; references: 4 Russian.
[300-6415]

TRAJECTORY FILTRATION WITH COMPOSITE USE OF DATA FROM TWO MEASURING INSTRUMENTS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 19 Dec 80, after completion 2 Jun 81) pp 66-68

KOVAL'CHUK, I. A. and GORBUNOV, A. P.

[Abstract] A target tracking algorithm is shown for use by a radar with data from two measuring instruments. The general case of asynchronously operating instruments is considered, motion of the target being represented by a linear model where the Gaussian random sequences with zero mean in the state vector and in the measurement vector are noncorrelated. The optimum (with minimum mean-square error) estimate of the target state is obtained by processing sequences of readings from the two instruments at any instant of time according to the Kalman filtration algorithm, using a variable transition matrix for varying time intervals between readings. The algorithm involves solution of covariational equations and yields a prediction of the target distance with a dispersion which is a periodic function whose period can vary between the two periods of covariation of readings from the two instruments. Figures 3; references 4: 2 Russian, 2 Western (1 in translation).
[276-2415]

UDC 535.31

TRANSPARENT WEDGE FIELDS UNDER BEAM RADIATION INCIDENCE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 20 Aug 80) pp 634-641

IVLEV, Ye. I., POLUKAROVA, V. N. and AYVAZYAN, Yu. M.

[Abstract] The problem is considered of obtaining in a geometrical-optical approximation, simpler (neglecting diffraction) expressions for fields inside and outside of a wedge during incidence on it of a three-dimensional radiation beam. In the present work the term "transparent wedge" is utilized for materials, nonabsorbing radiation in the spectral band considered. A wedge is considered which is found in a transparent medium on which beam radiation is incident. Absolute indices of refraction of the material of the wedge n_2 and the medium n_1 are assumed to be valid. Also considered are cases when the relative index of refraction $n_{12} = n_2/n_1$ does not exceed unity. Expressions are presented for a reflected field in the case of incidence of a weakly diverging plane wave and Gaussian beam. Figures 2; references 16: 12 Russian, 4 Western (1 in translation).
[300-6415]

UDC 621.396.67.012.12

MAXIMUM EMF IN RECEIVER ANTENNA OF BIOTELEMETRIC SYSTEM

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 9 Feb 81) pp 32-35

PERSHIN, N. N.

[Abstract] A biotelemetric system used in medicine or sport consists of a stationary receiver and a transmitter moving with the biological object. Expressions are derived for the maximum emf in the receiver antenna in case of optimum matching of receiver and transmitter radiation patterns. The radiators are regarded as an electric Hertz dipole and a magnetic Hertz solenoid-dipole, the length of the former and the diameter of the latter much shorter than the wavelength and than their distance from the receiver. Both transmitter and receiver are energized with sinusoidally alternating current. The maximum emf

is calculated accordingly for "electric dipole - magnetic dipole" and "electric frame - magnetic frame" receiver-transmitter pairs operating at frequencies of 2, 4, 100 MHz. The distance between them is decreased from 1000 to 1 m and the correspondingly increasing error evaluated. The author thanks V. L. Zuzenko for interest and helpful suggestions. Figures 3; references: 3 Russian. [280-2415]

UDC 621.396.677

SYNTHESIS OF OPTIMUM MULTIBEAM ANTENNA ARRAY WITH FEEDTHROUGH OF OPTICAL EXCITATION

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 2 May 81) pp 66-68

KAKHANOVICH, V. A. and TSARYUK, D. A.

[Abstract] A linear antenna array of $2N+1$ elements with feedthrough optical excitation is considered, the excitation system being equivalent to two con-formal arrays facing one another. Elements of the collector array lie on a curve convex toward the antenna array and are connected to elements of the latter through transmission lines with phase shifters in series. Elements of the radiator array lie on a curve farther away from the antenna array and concave toward it. Synthesis of such an excitation system is based on the condition of a linear phase front in an r -dimensional Euclidean space. Optimization of this excitation system according to the criterion of minimum mean-square error proceeds in r stages, in each stage the optimum solution to the governing equation being sought successively for each element of the radiator array. Calculations and results are shown for a spherical radiator array with variable radius of curvature and zero phase shift along the principal axis. Figures 2; references 2: 1 Russian, 1 Western. [280-2415]

UDC 621.396.677.49

MAXIMUM SIGNAL POWER AT ANTENNA RADIATION PATTERN OUTPUT WITH CONTROL OF POLARIZATION RADIATED FIELD

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 10 Nov 80) pp 712-715

KORNIYENKO, L. G. and OSIPOV, A. S.

[Abstract] Ordinarily, it is assumed that a receiving antenna must be completely matched in polarization with the incident wave. However, sometimes a limited mismatch with respect to polarization is tolerated, and it is possible to increase somewhat the directive gain of the antenna, which leads to an increase of the signal power at the output. In confirmation of this the present

paper considers the problem of maximization of the signal power separable at the matched load of a linear antenna composed of N cross-shaped elementary dipoles with controlled polarization of the field. The results of the solution of the optimization problem for $N = 4$, $d = 0.5 \lambda$, $\theta_0 = 90^\circ$, $Q_0 = 0^\circ$ and various phases ρ_0 are presented in a table in which optimum amplitude--phase distributions in half-arrays are shown. The possibility is considered of creating gaps in the directional diagram in specified directions. Figures 2; references: 6 Russian. [300-6415]

UDC 621.396.677.49

ALL-PURPOSE AUTOMATED MEASURING COMPLEX FOR STUDY OF PHASED ANTENNA ARRAYS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 6 May 81) pp 61-63

AFROMEYEV, A. S., KAPLUN, V. A., MAYOROV, G. I., PROKHOROVA, O. L., SAPALEV, V. I. and SYTSKO, G. A.

[Abstract] A programmable automated measuring complex for analysis and synthesis of phased antenna arrays has been developed on the basis of semiphysical and mathematical modeling with the aid of a control computer complex (SM-2 and YeS-1050) and tracking systems. This SAIK (All-Purpose Automated Measuring Complex) can control phase shifters within the sector of electronic scanning, control tracking equipment, document results of tests and simulations, determine directive gain and efficiency, simulate reliability characteristics by method of multivariate Markov processes with discrete and continuous components, automatically process statistical data by paired correlation-regression analysis and the method of least squares, apply Fisher's criterion, and perform engineering calculations for design of phased antenna arrays and their components. Spatial configurations and energy characteristics of such arrays have been established with this complex, and the effect of large deflectors has been evaluated and distortions corrected. Figures 2; references: 6 Russian. [280-2415]

UDC 621.396.679.6.001.5:621.396.965

EFFECT OF PHASE ERRORS ON SPECTRAL CHARACTERISTICS OF ANTENNA FIELD

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 19 Oct 79) pp 63-66

SMIRNOV, Yu. V. and MIKHAYLOV, G. D.

[Abstract] The spectral characteristics of an antenna field are calculated with the statistical parameters of the amplitude-phase distribution taken into account. The distorting effect of random phase errors, caused by variance of the slope of the linear characteristic of phase shifters in an antenna array, is determined for a linear equidistant array of N radiators. The results indicate permissible levels of phase error and can be useful for design purposes. Figures 2; references: 1 Russian. [280-2415]

UDC 531.252.6

MECHANICAL RELIABILITY OF OPTICAL FIBERS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 2 Nov 81) pp 26-32

ALEKSANDROV, I. V., ZHABOTINSKIY, M. Ye. and SHUSHPANOV, O. Ye.

[Abstract] The reliability of optical fibers can mean their ability to perform satisfactorily over a certain period of time or can be characterized by the length of their useful life. It has been experimentally established that the life of modern optical fibers produced by deposition from the vapor phase does not exceed a few years. Corrosion of the glass surface is not the only mechanism of cracking and fracture under tension. Thermal fluctuation of atoms produces internal thermoelastic stresses under tension. Both mechanisms are analyzed here on the basis of physical models and calculations reveal that corrosion cracking occurs much faster. Figures 2; references 15: 6 Russian, 9 Western.
[280-2415]

UDC 621.315

NEW TYPE OF PROTECTIVE COVER FOR COMMUNICATION CABLES IN ALUMINUM AND STEEL SHEATHS

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 (manuscript received 4 May 81)
pp 46-48

KAMBUROV, A. V., LAKERNIK, R. M., NIKOL'SKIY, K. K., SKOROSPELOVA, Ye. V. and FEDOSEYEVA, Ye. G.

[Abstract] Corrosion-proof protective covers in the form of low-density (high-pressure) polyethylene sleeves with bitumen filler, for underground communication cables in aluminum and steel sheaths, are produced at the "Moskabel" plant since the middle nineteen sixties. Polyethylene with a melt fluidity index $I = 1.5$ g/10 min has since the nineteen seventies been replaced by another grade with melt fluidity index $I = 0.3$ g/10 min, more crack resistant and mechanically stronger on cable under stress in aggressive media but also more vulnerable to damage during the assembly process. An experimental study was

made, therefore, to determine the feasibility of using high-density (low-pressure) polyethylene instead. Sleeves of 1.7-1.8 mm thick 204-11K (high-density) and of 2.5-2.8 mm thick 153-10K (low-density) were tested in an RM-250 tensile machine. Their mechanical characteristics were evaluated comparatively on basis of respective "load-elongation" diagrams up to rupture. Sleeves of 204-11K high-density polyethylene were found to be strong and elastic, with 700-900% elongation during rupture under 230-350 kgf/cm² stress. Such sleeves were also tested on three types of 4x4 cable (MKSAShp, MKSStShp, MKSABpShp) and found to have a life over 1000 h in surface-active media, to withstand 0.5 N sodium hydroxide or 0.8 N acetic acid for over 1200 days, and to have more stable dielectric and insulation properties ($1 \cdot 10^{12}$ ohm·m after 1200 days soaking in water) than low-density polyethylene. Polyethylenes based on ethylene+propylene and ethylene+ α -butylene copolymers are now under investigation. Figures 4; tables 1; references: 4 Russian. [279-2415]

UDC 621.396.22.029.7

RESULTS OF TESTING EXPERIMENTAL COMMUNICATION LINES ON OPTICAL FIBER CABLE

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 23 Oct 81) pp 81-82

MURADYAN, A. G., ZARKEVICH, Ye. A., MAKEYEV, O. N., USTINOV, S. A.,
DOGADKIN, A. B., GRAFUTKO, B. V., ASTAPOVA, P. A., SMIRNOV, V. P.,
KABANOVA, S. A. and DOVLATBEGOV, G. P.

[Abstract] Three optical fiber cables have been installed in experimental communication systems operating with pulse-code modulation. One has operated since 1977 in a pilot intraplant telephone system with IKM-12M terminal equipment (loss in cable 35 dB/km); a second since January 1980 in the automatic exchange of a pilot inter-institutional telephone system for transmission of 2.048 Mbit/s (mean loss in cable 15 dB/km); and a third since November 1981 in the automatic exchange of a pilot interurban telephone system for transmission of 8.448 Mbit/s with IKM-120 equipment (mean loss in cable 15.3 dB/km). Such a cable has also been installed and has operated since November 1980 in one of the USSR cities for interurban telephone transmission of 2.048 Mbit/s (mean loss in cable 12.5 dB/km). Measurements are made regularly at critical points of these cables, particular attention being paid to a change in losses. Cable segments where such changes have occurred, especially during interseasonal temperature changes, are thoroughly probed for local inhomogeneities. A special test stand has been built for power measurements. The results obtained so far indicate a high stability of optical radiation power from these cables with an error factor of the order of 10^{-9} during transmission of pseudorandom PCM signals. On the basis of available data, one can anticipate that such cables will have a service life on the order of 10^4 hours. References: 5 Russian. [280-2415]

PROBABILITY OF OBJECT IDENTIFICATION BY TELEVISION MONITOR SYSTEMS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 5, May 82 pp 42-45

KURAPOV, YE. F. and PETRAKOV, A. V., All-Union Correspondence Institute of Electrical Engineering of Communications

[Abstract] The probability of object identification by a television monitor can be determined on the basis of statistical representation of its resolving power. In the presence of interference it is necessary to assume a blurred discrimination threshold for small individual elements of an object. The mean identification probability depends on the monitor's vision threshold and angle, on aperture distortions, on nonuniformity of background brightness, on the dimensions of object and individual elements, on the contrast and signal-to-interference ratio, as well as on performance characteristics of transmitter and receiver picture tubes (dynamic contrast characteristics, luminous and semi-tone characteristics). Calculations taking into account these factors have been programmed on a YeS-1020 Unified System computer. The mean probability of identification of an object such as a human silhouette was calculated for super-orticons LI214 and LI201 (optimum illuminance 0.02 and 0.3 lx, respectively), for vidicons LI421 and LI415 (optimum illuminance 3 and 5 lx, respectively), and several other devices (TW2750, E5036, XQ 1020). Figures 9; references: 6 Russian.
[278-2415]

UDC 778.5(47+57)

REVIEW OF BASIC 1981 TECHNICAL ACHIEVEMENTS IN PROFESSIONAL CINEMATOGRAPHY

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 5, May 82 pp 9-26

BONDARCHUK, V. M. and IRZ, P. V., Central Design Office of Cinematography, GILINSKIY, A. G. and DROZDOV, V. M., "Ekran" Scientific-Industrial Association, and also the Department of Scientific and Technical Information at the All-Union Scientific Research Institute of Cinematography

[Abstract] Hardware produced in 1981 for professional cinematography covers four major areas: 1) Motion-picture taking; 2) Sound recording and playback; 3) Film processing and printing; and 4) Film projection and winding. New equipment in the first category includes two cameras ("Kinor-35" 60/150 m 8-32 frames/s and "Kinor-16" 120 m 8-64 frames/s), three variable-focus objectives (350PF25-2/2A and 700PF7-1, KER-15 remote-control module) and three luminaires ("Mars-2000/3000 M" for newsreels and "Fara-M" for studios). New equipment in the second category includes control consoles (K70K-31 audio operator's control desk, 90K-45 audio monitor panel, "Test 70-81" recorder of control phonograms), a synchronous magnetic sound recording and playback set (KZMP-11), microphones (KMKE-9 electret for concert halls) and earphones (12A-33). New equipment in the third category includes film processors (hydraulically operated 47P-9/11 and 43P-1 developers with fixing and drying, ESM-1 general-purpose rinser, 35L2 splicing press) and accessories (25P-103 and 26P-105 centrifugal pumps, 2P75/77/79 heat exchangers with automatic temperature regulation, P47 filter), film

reproducers (23MT01/3 black-white and color film copiers, 12P-14 winder-printer, KPPL-1 auxiliary production-inspection-circulation set). New equipment in the fourth category includes a motion-picture projector ("Ukraina-7"), accessories (A221B attachment with ventilation and lighting for "Ksenon-5" projector, OKM-5 luminaire with DKSShRB-500 xenon lamps, VKT-10 40V-265A rectifier, RUK 10-7 power distributor) and automatic motion-picture presentation sets (35UDP-M "Festival", UNK-5 with "Raduga-2" projector. KDB with "Proton" diaprojector) also AZK 35 set for exhibitions and museums. Figures 30, tables 1.
[278-2415]

TELEVISION AND RADIO BROADCASTING, RADIO COMMUNICATION AND RADIO RELAY
COMMUNICATION IN RSFSR IN 11th FIVE-YEAR PLAN PERIOD

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 pp 9-11

GORMAKOVA, N. I.

[Abstract] An all-Russian conference was held in October 1981 in Volgograd on television and radio broadcasting, radio communication and radio relay communication in the RSFSR. It covered the present status as well as projections for 1981-85 and 1986-90 periods. Over 200 participants included managing personnel from RSFSR and USSR Ministries of Communication and Communication Equipment Industries as well as representatives of scientific research and planning institutes. Major topics presented and discussed were introduction of a second all-Union television program covering the entire vast USSR territory with an 80% increase of the number of interurban channels, production of television and ultrashort-wave FM power transmitters, production of radio transmitters (long-wave, medium-wave, short-wave), design and antenna-feeder systems, application of power oscillator tubes, installation and operation of radio transmitters, improvement of inspection and measurement techniques, modernization and redesign of existing low-power radio relays, geodetic surveys for installation of antenna towers, cooling the radio broadcasting power equipment, design and performance of side-lobe filters in short-wave transmitters and of field intensity meters, and organization of maintenance, repair, and alignment service in communication enterprises.
[279-2415]

DEVELOPMENT AND PRODUCTION OF NEW SOVIET-MADE HIGH-POWER TELEVISION AND ULTRA-SHORT-WAVE FM RADIO STATIONS

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 pp 14-17

KOZLOVSKIY, M. M.

[Abstract] New high-power television and ultrashort-wave FM radio stations have been designed in the Soviet Union on the basis of CMEA as well as GOST 20532-75 and 13924-80 channel precision standards, with i-f modulation, with synthesized exciters, with highest-quality components (cermet tetrodes and klystrons, with transistorization of all except power output stages, with the most economical layout and assembly, with a high degree of automation, and with simultaneous amplification of image and sound track radio signals. Ultrashort-wave FM radio stations are moreover, designed for multi-programmability, stereophonic transmission and reception, and with maximum utilization of existing equipment. New radio stations now in production are the fourth-generation ATRS-5/1 I-II and ATRS-5/1 III, the "Il'men" (TV-25/5 IV-V), and the "Dozhd'-2M", "Dozhd'-4". Already in production is the "Yakhont-KI" inspection and measuring equipment for television stations, which replaces the existing "Yakhont-A" version. Figures 2.
[279-2415]

INSTALLATION AND OPERATION OF SRV-7 RADIO BROADCASTING TRANSMITTERS

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 p 19

NESTERENKO, V. A.

[Abstract] In accordance with the plan to provide third-program radio broadcasts to the entire population of the RSFSR, SRV-7 transmitters have been scheduled for installation in Arkhangelsk Oblast, to cover a territory of 35-45 km radius. These receivers are designed, assembled and aligned to meet NIIR (Scientific Research Institute of Radio) specifications on electromagnetic compatibility with television equipment. These include careful grounding of high-frequency components, "sloping array" orientation of antennas away from the television tower, careful shielding of radio relay and television relay cables, and insertion of interference suppressing filters into the electrical power feeders to individual television bays. There is hardly any interference with ultrashort-wave FM radio broadcasting equipment. These transmitters operate stably. Main causes of shutdown are malfunction of the GU-47B oscillator tube, of relays or resistors, and overheating of the ARB-1 exciter.
[279-2415]

RADIO AMATEURS HELP NATIONAL ECONOMY

Moscow RADIO in Russian No 2, Feb 82 pp 25-27

BORNOVOLOKOV, E.

[Abstract] The 30th National Jubilee Exhibit of the Creativity of Radio Amateur [ham] designers has confirmed the fact that metallurgy and agriculture, medicine and construction as well as scientific research and mining have been assisted by the golden hands and great creativity of radio amateurs. Ye. Figurnov, a professor at the Railroad Transport Engineering Institute in Rostov na donu, working with a group of friends, has produced 8 interesting designs now in use in the nation's commercial electric railroads. They include original spark sensors to determine areas of poor contact between overhead power lines and train contacts and a remote infrared thermometer which can be used to determine the temperature of electric and power engineering equipment without disconnecting the high voltage equipment. It can determine temperature differences of 0 to 150°C between the body of the thermometer and any other object from a safe distance in less than 1 second. The minimum detectable temperature difference is 5°C. Use of one such thermometer can yield a savings of almost 35,000 rubles per year. Other examples of the creativity of hams include an automatic liquid level meter for use in wells, a universal measurement transducer, a depth finder, seed treatment system and electroacupuncture equipment. Figures 5.
[205-6508]

UDC 621.373.5

MAGNETIC THYRISTOR GENERATOR OF RADIO PULSES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 25, No 5, May 82 (manuscript received 17 Feb 81) pp 77-80

MELIKHOV, Yu. M.

[Abstract] Magnetic thyristor generators of radio pulses can operate at frequencies up to several hundred kilohertz. The performance of a two-stage generator with a series capacitor as well as a series thyristor and shunt thyristor in the transformer primary and with shunt capacitor and saturable reactor in series with the load in the transformer secondary is analyzed here in the four stages of an operating cycle: 1) From firing to cutoff of series thyristor, series capacitor is charged; 2) From firing of shunt thyristor to saturation of reactor core, series capacitor is discharged and shunt capacitor is charged; 3) Reactor core remains saturated, shunt capacitor is discharged though load and damped oscillations are generated; and 4) From demagnetization of reactor core to cutoff of shunt thyristor. Voltage and current relations during each stage are established on the basis of an equivalent-circuit diagram, whereupon transients and power characteristics (efficiencies) are calculated. The solution of circuit equations has been programmed in FORTRAN-4. Figures 3; references 4: 3 Russian, 1 Western.
[276-2415]

UDC 621.382.323

BASIC COMPONENTS OF MICROPOWER CIRCUITS WITH FIELD-EFFECT TRANSISTORS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 6 Mar 81, after completion 1 Jun 81) pp 55-60

SUKHORUKOV, A. I., PEREVERZEV, A. V. and KRASNOPOL'SKIY, A. G.

[Abstract] Micropower circuits based on complementary field-effect transistors with a control p-n junction feature low power drain and high thermal stability as well as high resistance to radiation and high operating speed. Their basic components, diodes and transistors with Λ -characteristics, consist of two complementary transistors connected in series, A computer method of evaluating

their static and dynamic parameters is described which uses the one-dimensional multisegmental model of such a device with an $\bar{I}_i = -n[3(\bar{V}_i - \bar{V}_{i-1}) - 2(\bar{V}_i^{3/2} - \bar{V}_{i-1}^{3/2})]$ current-voltage characteristic for each of the $i = 1, 2, \dots, n$ segments. The method is convenient for design and performance calculations, a typical application being comparative evaluation of field-effect transistors with control junction and CMOS transistors with built-in channel. Figures 5; references: 6 Russian. [276-2415]

UDC 621.391

ALGORITHM OPTIMIZATION OF COMPLEX PULSE AND CONTINUOUS RANDOM SIGNAL PROCESSING

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 25 Sep 81) pp 752-760

YARLYKOV, M. S. and ARTEMENKOV, V. S.

[Abstract] The problem of synthesis of a device for reception and combined processing of pulse and continuous random signals is solved by the method of the Markov theory of optimum nonlinearity of evaluation. It is assumed that the observation vector contains three components. The vector sufficiently describes the general case of measurement of random processes and their first two derivatives. The available signal in one component--a pulse radio signal with an unknown time of arrival and random phase--and two other components are considered to be low-frequency random processes. Both the radio pulses and the low-frequency processes contain, in addition to the corresponding accompanying parameters, the same or functionally connected interference parameters to be evaluated. The values of the dispersion of the filtration errors obtained with the aid of a digital computer makes it possible quantitatively to evaluate the precision and noise immunity of the synthesized devices for optimum joint processing of signals to determine the gain because of integration. Figures 5; references 9: 8 Russian, 1 Western in translation. [300-6415]

UDC 621.372.037.372

ROUNDING NOISE IN DIGITAL FILTERS AT SMALL INPUT SIGNAL

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 13 May 81) pp 39-42

ITSKOVICH, Yu. S.

[Abstract] Correlation noise in digital filters at a small input signal and, particularly, the limit cycle in case of zero input signal are calculated for

a second-order filter section. Three types of damped oscillations, depending on the coefficients in the difference equation and on the initial state of the filter section, are found to occur as the filter section is tuned to a cutoff frequency close to zero or half the quantization frequency. A small signal will cause the state of the filter section to depart slightly from the limit-cycle state. On the basis of this analysis, one can minimize the effect of rounding noise of filter performance and extend the dynamic range of signals to be processed by making the transfer ratio of the noisiest sections much larger than unity and processing the signals in a low-noise section with a transfer ratio much smaller than unity. Another method, applicable to narrow-band filters, is filtration of the noise from the noisiest sections by other sections. Figures 3; references 6: 3 Russian, 3 Western.
[280-2415]

UDC 621.391.26

OPTIMUM SIGNAL FILTERING AND INTERFERENCE COMPENSATION

Moscow *RADIOTEKHNIKA I ELEKTRONIKA* in Russian Vol 27, No 4, Apr 82
(manuscript received 5 Jun 80) pp 742-745

KOTOUSOV, A. S.

[Abstract] Problems of the reception of signals on a background of Gaussian structurally-determined interference are considered. The interference is functionally connected with vector or continuously varying in time random parameters. In the case of optimum reception of a signal in the flow of structure-like interference signals to it, knowledge of the form of the signals has a significant value. An interference signal is structurally-determined (SD) if its form is known in any continuous interval of observation (as much as is desired) with precision up to some set of random varying parameters. A random signal is described as quasi-determined if this set consists of a finite number of elements. Because of the compensation effect, use of information concerning the form of the interfering signal creates a precondition for a significant suppression of interference. In the case of linear coding of the Gaussian parameter λ in the structure of interference $r(t, \lambda)$, the interfering signal is Gaussian. During this, the arrangement and the effectiveness of optimum filters with the action of SD-interference arises from the theory of optimum linear filtration of signals. Other approaches to the solution of this problem are discussed. References: 4 Russian.
[300-6415]

NOISE FILTERING BY PHASE-LOCKED LOOP

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 3 Mar 80, after correction 12 Feb 81) pp 737-741

BLATOV, V. V.

[Abstract] Although an evaluation of noise filtration by a system of phase automatic control (PAC) is necessary in many cases, formulas for this purpose obtained from the literature have determined limitations. In the present work filtration of the exterior noises of a PAC system of the first order is considered. Formulas for calculation of the filtration factor of the phase are presented with respect to a specified spectra density of noise and with respect to the frequency character of the input filter, allowing for the frequency difference of the reference signal relative to the resonance frequency of the filter. The filtration factor of the phase is found for several cases important in practice. The results of calculations are presented for ideal, single-circuit and bell-shaped (Gaussian) filters. The formulas obtained in the work can be used during calculation of the filtration factor of phase by a PAC system. Figures 2; references: 6 Russian.
[300-6415]

SYNTHESIS OF DIGITAL RECURSIVE BAND ELIMINATION FILTERS WITH CONSTRAINTS IN FREQUENCY DOMAIN

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 9 Jan 81, after revision 2 Mar 81) pp 42-47

POPOV, D. I., KOSHELEV, V. I. and GUS'KOV, S. V.

[Abstract] The efficiency of processing radar signals with correlated clutter can be substantially improved by shortening the transient periods during discrete scanning by means of the use of recursive filters of this type with a structure tunable by commutation of feedback couplings. Synthesis of such filters is generally based on the amplitude-frequency characteristic alone as optimality criterion. Here a method of synthesis according to a complex criterion is shown, based on parametrization of the amplitude-frequency characteristic and subsequent use of those parameters as independent variables or constraints. The iterative algorithm of this synthesis is demonstrated on filters consisting of p nonrecursive first-order sections, q recursive first-order sections, r nonrecursive second-order sections, and s recursive second-order sections. The algorithm includes processing direct and feedback couplings through determination of their weight factors, transition to the frequency domain, and maximization of the clutter suppression factor, a functional of the vector of parameters derived from the amplitude-frequency characteristic. It is applicable

to filters for continuous scanning as well. Numerical results are shown for the case of clutter with an approximately Gaussian spectral density. Figures 3; references 8: 4 Russian, 4 Western.
[276-2415]

UDC 681.33

MODELING ONE CLASS OF NONLINEAR TWO-POLE NETWORKS WITH FIELD-EFFECT TRANSISTORS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 4, No 1, Jan-Feb 82
(manuscript received 5 May 80) pp 32-36

PROKOF'YEV, V. Ye., BASTRIKOV, Yu. M. and FRID, A. V.

[Abstract] A nonlinear two-pole network with a current-voltage characteristic $I = AU^p$ ($0 < p \leq 1$) is the essential element in electrical direct analog models of fluid supply and distribution systems. Such a nonlinear network is usually synthesized through piecewise-linear approximation, with pedestal voltage sources serving as memory elements for the coordinates of nodal points. The model hardware can be simplified by elimination of the pedestals and using field-effect transistors as current limiters for storage of the nodal coordinates. A typical n-channel field-effect transistor with resistive feedback has a steep current-voltage characteristic from zero to cutoff voltage and a flat constant-current characteristic in the saturation range. In the parallel scheme of modeling one represents the broken line as the sum of one linear function and N functions with limits (corresponding to N nodes in the approximation), the former simulated with a single resistor and the latter simulated each with a current limiter and an approximating resistor in series. The approximating resistors must match the feedback resistors in the corresponding transistor stages, to minimize the error of linearization of the 3/2-power current-voltage characteristics of the latter. It may be necessary to refine the linearization by adding an operational amplifier. Calculations and excellent results are shown with KP303B transistors used in an $N = 4$ network model, with a linearization error not exceeding 1% and a current error not exceeding 0.03 mA or 1.5% of the upper current limit. Silicon field-effect transistors have inter-electrode capacitances of the order of a few picofarads, and approximating resistors of 10^4 - 10^5 ohms almost entirely eliminate any phase shift in the 10^5 - 10^6 Hz frequency range. Figures 8; references 11: 10 Russian, 1 Western in translation.
[184-2415]

COMMUNICATIONS

UDC 621.3.029.5/6

COMPLEX EVALUATION OF RECEIVER STATION EFFECTIVENESS WITH RESPECT TO ELECTROMAGNETIC COMPATIBILITY

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 (manuscript received 29 Mar 81)
pp 29-34

VINOGRADOV, N. V.

[Abstract] Effectiveness of a receiver station in a radio system which broadcasts over several frequency channels is evaluated on the basis of a complex criterion of electromagnetic compatibility. This criterion is the overall load on a receiver by signals in the interference zone, defined as the sum of frequency sidebands multiplied by the volume of space within which all these sidebands could be received without shielding. The load factor thus defined depends on channel selectivity, stability of carrier frequencies, antenna characteristics such as radiation pattern, power scattering, mismatch between transmitter and receiver polarization, receiver characteristics such as nominal signal-to-noise ratio, intrinsic and background noise. Both relative and effective selectivity characteristics are determined through power measurements and calculations for each interference frequency band. This method of evaluation, based on the most general concepts, is universal as well as consistent and comprehensive. It can be used for estimating the probability of faultless reception under real operating conditions and establishing the maximum permissible interference level. The author thanks S. V. Borodich and L. Ye. Varakin for support and assistance in developing the complex criterion of electromagnetic compatibility consistent with the IRCC 662 report, as well as N.V. Golubev for many helpful suggestions. Figures 5; tables 2; references: 7 Russian.
[279-2415]

FEASIBILITY OF USING SUBMINIATURE CABLES FOR TRANSMISSION OF HIGH-FREQUENCY AND MICROWAVE ANALOG AND PULSE SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 24 Jul 81) pp 17-21

IONOV, A. G., LAPTEV, A. A. and KHRENKOV, N. N.

[Abstract] Four prototype subminiature coaxial radio-frequency RK50 cables were designed and built for evaluation of electrical and performance characteristics, with the diameter over insulation 0.15, 0.30, 0.6, 2.95 mm respectively and with outer conductor made of copper (inner conductor made of KhOT alloy, except silver-coated copper conductor in largest cable). The frequency dependence of attenuation coefficient, delay time, characteristic impedance, group and phase velocities, also nonlinearity of the phase-frequency characteristic were measured over the 10^5 - 10^9 Hz range. Comparison of experimental data with calculations based on equations of electrodynamics and telegraph equations for cables with dielectric filling the entire space between conductors reveals some anomalous departure from nominal values at 10^8 - 10^9 Hz frequencies, because wavelength and field penetration depth in the metal become here comparable with the radial distance between conductors. Waveforms of signals and signal envelopes at cable input and cable output were recorded with an oscillograph. Reflectograms reveal structural inhomogeneities, which can be minimized by modern technological means. The results indicate feasibility of using such cables as short communication lines for transmission of analog and microwave pulse signals, for connections in integrated and hybrid circuits, for wideband transformers and matching devices, also as field probes inside resonators and waveguides. Figures 7; tables 1; references 5: 3 Russian, 2 Western.
[280-2415]

UDC 621.372.542

ECONOMICAL ALGORITHM OF MULTIDIMENSIONAL FAST FOURIER TRANSFORMATION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 23 Jan 81) pp 63-66

VASYUK, G. I. and KRUKOVSKIY-SINEVICH, K. B.

[Abstract] An algorithm of multidimensional fast Fourier transformation is shown which involves cascading and inversion through simultaneous cutting of the input data array along all coordinates into subarrays. It is demonstrated on the two-dimensional fast Fourier transformation of a square data array. The latter is cut along rows and columns into square subarrays, which are then shifted along rows and columns, transformed, reassembled, etc. until the entire data array has been transformed. There are 50% fewer nontrivial multiplications and 25% fewer total multiplications here than in the sequential two-dimensional fast Fourier transformation, nontrivial multiplications occurring not in each but in every fourth cascade. However, calculation of the inverting multipliers is more laborious. Figures 2; tables 1; references 2: 1 Russian, 1 Western in translation.

[276-2415]

USE OF STOCHASTIC CODES IN UNIVERSAL ALGORITHMS OF IMMUNIZATION AGAINST ERRORS

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 (manuscript received 18 Nov 80)
pp 39-43

OSMOLOVSKIY, S. A.

[Abstract] Universal algorithms of error detection and error correction are proposed for ensuring error immunity in one-way and two-way channels. This is achieved by use of stochastic codes. A single code and a single device would be used, the operations being the same for error detection and error correction with only the number of operations being different in each case. The device is first set for error detection and then, if necessary, switched to error correction with addition of redundancies to the code. The element of such a q -ary code is a binary sequence segment $q = 2^L$, L being selected on basis of the requirements that the probability of error detection be $P_{err, det} > 2^{-L}$. The code is constructed in two stages: first $n - k$ redundant q -ary symbols are formed with aid of a binary (n, k) code and a test matrix, then all q -ary symbols are converted stochastically by means of a quasi-random ξ -sequence of length L for each. Error detection in systems with feedback requires only one redundant symbol, sum of $n - 1$ informative symbols. Error correction is more laborious and proceeds in three stages. The efficiency of stochastic codes, characterized by the way in which the number N of decoded symbols decreases stepwise with increasing error multiplicity t (number of symbols distorted in channel) and when it becomes smaller than the number $M = n - t$ of correctly received symbols, is higher than that of $(5, 11)$ and $(7, 4)$ Hamming codes as well as that of $(8, 4)$ code with distance $d = 4$. Such codes can be used in the basic algorithm of ensuring error immunity, they can also be extended to crosswise decoding along (n, k) rows and $(m, 1)$ columns for use in transmission systems with resolving feedback. Figures 5; tables 1; references: 5 Russian.
[279-2415]

UDC 621.391.2:519.81

MINIMAX ESTIMATES OF AVERAGE RISK IN SYSTEMS WITH PREDISTORTION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 11 Feb 81, after revision 28 May 81) pp 47-51

MARIGODOV, V. K.

[Abstract] A conflict situation is considered where operators of data transmission systems and operators of a radio interference system interact. The effectiveness of signal predistortion and correction in this case is evaluated according to the theory of games, on the basis of the average risk as payoff function. Signals are assumed to be transmitted through a channel with additive interference, only incomplete information about the probabilistic characteristics of this channel being available to the operator of the data transmission

system. The predistortion and correction problem is solved by estimating the minimax average risk, the average risk being a multivariate functional with the cost function assumed to be quadratic, and accordingly also optimizing the strategies of players. This minimax average risk or price of the game depends neither on random processes $x(t)$ at the input to a linear predistorting filter and $y(t)$ at the output from a linear correcting filter nor on the distributions of $p(x)$, $p(y)$, $p(x/y)$, $p(y/x)$ reception probabilities. It depends on the signal-to-noise ratio, the effectiveness of predistortion and correction increasing as that ratio decreases. Figures 1; references: 7 Russian. [276-2415]

UDC 621.391.26

ALGEBRAIC METHODS OF ANALYZING PSEUDORANDOM PHASE-MODULATION SIGNALS WITH A PRIORI INDETERMINACY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDNIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 6 Apr 81, after revision 18 Sep 81) pp 93-95

VLASOV, A. V.

[Abstract] Code stability of signals is characterized by the time required to determine the signal parameters. Here an algebraic method is used for analyzing the code stability of M-sequences, a subclass of pseudorandom phase-modulation signals which obey a linear recurrence relation. With carrier frequency and clock frequency at the receiver known, such a signal is converted to a video-frequency code sequence. The method of analysis is based on two theorems. One, proved by mathematical induction, states that the rank of the semiinfinite matrix A of sequence elements is equal to the degree n of the smallest polynomial characterizing this sequence. The second theorem, based on the first, states that for a minor $A_{n,n+1}$ of dimension $N \times (n+1)$ the vector of \vec{C} of coefficients in the recurrence relation is the nonzero solution to the system of linear algebraic equations $A_{n,n+1} \vec{C} = 0$. The procedure for undistorted sequences follows from these theorems. In the case of a distorted sequence the latter is subdivided into m segments and the procedure is repeated until the solutions to that system of equations coincide m times. References: 5 Russian. [276-2415]

DOPPLER EFFECT CALCULATION FOR COHERENT PROCESSING OF SPACE-TIME RADIO SIGNALS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 23 Feb 81) pp 721-728

KREMER, I. Ya. and GERMAN, A. M.

[Abstract] By means of a rigorous electrodynamic approach a description is given of the Doppler effect for a space-time radio signal in the form of a plane electromagnetic wave. An analysis is made of the relationships obtained as applied to problems of coherent reception of space-time signals. It is shown that in certain practical and important cases the approximate (nonrelativistic) descriptions of the Doppler effect widely presented in the literature are inapplicable. In addition, a generalization of the results obtained based on space-time processing of radio signals with spherical wave fronts is examined for cases of passive and active location. Important sections of the paper include: 1) Basic relations describing Doppler effect; 2) Coherent processing of signals with plane wave fronts [a: Calculation of radial component of target speed; b: Calculation of tangential component of target speed]; 3) Description of Doppler effect for spherical wavefront; and 4) Calculation of Doppler effect during active detection and ranging. Figures 1; references: 4 Russian.
[300-6415]

CORRELATOR OF SUM FREQUENCY OF WIDEBAND PHASE-MANIPULATED SIGNALS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 22 May 81) pp 53-54

MARCHENKO, V. F. and PETRIN, Yu. M.

[Abstract] A correlator of sum frequency for spectral analysis of wideband phase-manipulated signals is described which consists of a variable-delay line, a frequency multiplier and a selective receiver. A step-up frequency conversion is accompanied here by compression of the signal spectra so that the necessary resolution will be attained even in the case of overlapping spectra and the amplitude of the sum-frequency signal will be proportional to the cross(auto)correlation function for envelopes of the input signals. This is demonstrated on the example of two phase-manipulated signals with different carrier frequencies and shifted in time appearing at the input of a frequency multiplier with a $y = \alpha v^2$ characteristic, $v = A_1(t)e^{j\omega_1 t} + A_1(t-\tau)e^{j\omega_2(t-\tau)}$
($A_1(t)$ - complex amplitude of compound rectangular pulse of duration $T_0 = n\tau_0$, τ_0 - duration of discrete component). The correlator was tested experimentally, with an artificial transmission line constituting a low-pass filter serving as frequency multiplier. The authors thank I. T. Trofimenko for helpful discussion of the experimental results. Figures 3; references: 2 Russian.
[280-2415]

ENGINEERING OF EQUIPMENT FOR LINE-OF-VISION RADIO RELAY TRANSMISSION

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 (manuscript received 10 Nov 81)
pp 50-55

MARIMONT, Yu. I.

[Abstract] At the "Svyaz'-81" International Exhibition Soviet-made radio relay equipment for "line of vision" operation in the 2, 4, 6, 7, 8, 11, 13 and 15 GHz frequency bands was exhibited. Also shown was equipment made in Bulgaria, Hungary, Finland, France, Italy and Japan. Particularly interesting is the design of modern highly economical series 500 and 550 NEC (Japan) radio relay systems. Other noteworthy items includes series TFN-250 and TFN-260 Thomson-CSF (France) transceivers, series FHN 11-14 and FHN 13-06 Thomson-CSF and SAT (France) digital radio relay equipment, series HT-6u/2700 and HT-4L (fully solid state) Telletron (Italy) radio relay equipment, series KTT-80 and GTT-80 analog radio relay equipment built in Hungary. The equipment exhibited here illustrates a trend toward smaller sizes with lower energy consumption, toward improved reliability through conversion to exclusive use of active semiconductor devices, and toward higher transmission speeds in digital systems. Figures 3; tables 3; references: 4 Western.
[279-2415]

STANDARD TRANSMISSION ALONG COMMUNICATION CHANNEL CONTAINING LIGHT GUIDE CABLE

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 12 May 80) pp 813-819

BUDKIN, L. A., MOROZOV, V. P. and PIKHTELEV, A. I.

[Abstract] The contribution of the fundamental noise of an optical communication channel (OCC) to the instability of the frequency of the transmitted signal is theoretically analyzed for the case of amplitude modulation of the laser radiation. The basic relations connecting the magnitude of the noise and the instability of the transmitted frequency are obtained. This makes it possible to determine the requirements on the structure of the OCC for transmission of standard frequency signals. A block diagram of such an OCC is presented and the functions of its various units are explained. The basic types of noise of the communication channel under consideration are the amplitude of the radiation noise of the laser, fluctuation of the optical communication line, noise of the photoelectric current of the detector, as well as fluctuations of the phase and depth of modulation. Also necessary to consider is the quantum noise of the optical radiation field. It is assumed that the source of optical radiation is a semiconductor laser, the most promising for OCC. The principal contributions to instability of the transmitted frequency are described. Figures 1; references 16: 11 Russian, 5 Western (1 in translation).
[300-6415]

METHOD OF ABATING NONLINEAR DISTORTIONS IN RECEIVER AMPLIFIER CHANNELS WITH DIGITAL PROCESSING OF DATA

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 17 Aug 81) pp 87-90

POBEREZHSKIY, Ye. S.

[Abstract] A method of abating nonlinear distortions in receiver amplifier channels is proposed which utilizes the fact that such distortions do not occur at all instants of a voltage cycle. The method involves discretization of the voltage oscillations and is thus applicable primarily to digital processing of data. It is demonstrated on nonlinear distortions in the form of bilateral clamping in channels requiring a large analog part in order to ensure a wide dynamic range of the output voltage, and the output voltage is assumed to be quasi-harmonic. The error of this method is also evaluated: first with the instantaneous frequency $f(t)$ measured and assumed to vary linearly during measurement, then with $f(t)$ not measured. In the case of an additive mixture of sinusoidal signal and normal white noise at the input to the nonlinear element behind the analog component, calculations reveal that the error due to measurement inaccuracy is proportional to the oscillation amplitude. Various implementations of this method are possible, one shown here is where both phase and amplitude are determined from measurement of time intervals. Figures 2; references: 4 Russian.
[280-2415]

SYNTHESIS OF ALGORITHMS FOR TIME-POLARIZATION PROCESSING OF SIGNALS AND INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 29 May 80, after revision 11 Mar 81) pp 24-28

POPOVSKIY, V. V.

[Abstract] The power in a matched load is an important characteristic in radar and other communication problems involving polarization of signals and interference. It depends on the degree of polarization of the received electromagnetic wave as well as on the effective antenna surface, the angle between points on the Poincaré sphere, and the magnitude of the Poynting vector at the reception point. The problem is to maximize the signal power and minimize the interference power in the load, the effectiveness of this operation being determined entirely by the degree of polarization. The problem of estimating the polarization parameters, for the purpose of increasing the degree of polarization and consequently also the effectiveness of time-polarization processing, can be solved by means of a polarization filter. A discrete algorithm of

filtration, which involves estimation and adjustment of weight factors, is synthesized by the method of state variables and takes into account not only presence of isotropic white noise within the receiver band but also the estimation error of the correlated slowly varying intensity of the unpolarized component of an electromagnetic wave. The algorithm involves reception of a signal+interference mixture by two orthogonally polarized antennas, then weighing, adding, and comparing with the reference signal. This algorithm dynamically optimizes adjustments to variable and random in time changes of signal and interference polarization parameters. Its efficiency is demonstrated on extraction of a signal with unknown or randomly varying polarization from unpolarized background interference such as white noise. The algorithm becomes even more efficient when additional interference is involved, inasmuch as its inertia allows simultaneous minimization of all interference components. Figures 3; references 8: 6 Russian, 2 Western.
[276-2415]

UDC 621.397

DIGITAL SYSTEM OF DOCUMENTATION DATA TRANSMISSION OVER NARROW-BAND COMMUNICATION CHANNELS

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 2, Apr-Jun 82 (manuscript received 20 Apr 81) pp 57-59

SAVIS'KO, P. A., candidate of technical sciences, BALYASNIKOV, N. V., candidate of technical sciences, and RASKIN, A. G., engineer

[Abstract] A method is proposed for reducing the speed of a binary flux which describes a stationary television image and thus facilitating its transmission over a narrow-band channel. Video pulses are coded from the time a frame starts till the first n-digit register is filled, whereupon the coder stops and a memory device stores the coordinates of the stopping place. Coded data are transcribed into the second n-digit register, after the latter has been cleared by a parallel code, and are transmitted from here at a lower speed to the modem. In the meantime, the memory device triggers the coder at the instant when the current coordinates of the video signal coincide with those stored. The coder then repeats the operation with a new batch of data. At a typical rate of 2400 bits/s, transmission of a document on microfilm with a resolution array of 1125x860 elements takes 1-1.4 min, depending on its intricacy and on the coding algorithm. Figures 2; references 4: 2 Russian, 1 Polish, 1 Western.
[268-2415]

DIGITAL CODING OF AUDIO SIGNALS IN TELEVISION STUDIOS

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 5, May 82 pp 40-42

SHCHERBINA, V. I., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] Digital coding of sound is examined from the standpoint of compatibility with video signals and with signals in integrated communication networks, according to standard requirements for television and radio broadcasting studios. These requirements include compatibility with both digital and analog 625-line and 525-line television systems, which is satisfied by a sound discretization frequency of 48 kHz, availability of a service and control sound track along the program track, and possibility of sound hookup, all based on IRCC, ITTCC, IEC and ISO specifications. A typical grid of thirteen operating frequencies from 24 Hz to 13.5 MHz is produced from a 432 MHz base by an appropriate sequence of frequency divisions (frequency doubling and quadrupling being necessary in some instances). From the 13.5 MHz frequency as base is produced, also by successive divisions, another grid of six frequencies for video recording and hookup. Constant frequency ratios ensure fixed time relations between sound and image signals as well as between sound and other video signals or integrated-digital-communication signals with which the time relations may be different but must also remain fixed. Possible formats of a typical code for recording sound on video tape are designed on basis of these constraints. Such a code must contain words of equal lengths as well as redundancies for error correction, synchronization, and automatic control. Transposition of signals within a cycle reduces the repetition of errors due to lengthy fadeout, simplifies the electronic hookup and maintains a better accuracy of splicing. Figures 3; tables 1; references 4: 3 Russian, 1 Western. [278-2415]

UDC 681.322:621.39

MODELING SYSTEMS OF DIGITAL DATA TRANSMISSION OVER COMMUNICATION CABLE LINES

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 4, No 1, Jan-Feb 82
(manuscript received 4 Jan 80) pp 36-40

KHARUTO, A. V. and KOMAROV, V. V.

[Abstract] As one possible tradeoff between high speed and high accuracy of modeling digital transmission systems on a computer, it is proposed to use an approximate analytical model which relates the basic external characteristics of such a system to its internal parameters on the basis of statistical simulation experiments. The accuracy of calculations will then be determined by that of the statistical model, as is the rule, while the machine time will be much shorter. This approach is demonstrated on the regenerative channel segment of a digital transmission trunkline using a coaxial cable. The regenerative segment

consists of a line signal generator, a regenerator, a 1 km long coaxial cable segment, the receiver in the next in line regenerator, and a resolver, with a synchronization channel between the latter two. The first major problem in designing such a device is selection of the coding method with the necessary interference immunity, and thus estimation of the intersymbol interference as well as the probability of error in one symbol. This is done here for the case of pulse-code-modulation signals, a periodically stationary random process with nonanalytical distribution law. The mathematical model is constructed for a PCM line signal generator feeding rectangular pulses with n different amplitudes symmetrically distributed about zero to a receiver through a coaxial cable segment with the amplitude-frequency characteristic $L(f) = e^{-\alpha l \sqrt{f}}$ ($\alpha = 2.48$ dB/km attenuation along cable in standard 2.6/9.5 mm sheath according to ITTCC, l = length of cable segment). The receiver consists of an amplifier-corrector with the amplitude-frequency characteristic $K(f) = 1/L(f)$ and a low-pass filter with $M = 3$ sections. The noise characteristics are calculated, whereupon the dependence of the minimum signal-to-noise ratio in the correction band is determined for five codes (AML, 4B3T, 3B20, 6B301, 2B101) on the basis of maximum permissible probability of symbol error $P_{es, \max} = 10^{-10}$. Figures 5; tables 1; references 6: 2 Russian, 4 Western.

[184-2415]

UDC 681.324:681.327.8

DYNAMIC CONTROL OF DATA TRANSMISSION IN SINGLE CHANNEL BATCH-TYPE RADIO NETWORK

Kiev MEKHAIZATSIIYA I AVTOMATIZATSIIYA UPRAVLENIYA in Russian No 2, Apr-Jun 82
(manuscript received, after completion, 16 Oct 81) pp 42-44

BUKCHIN, A. M., engineer

[Abstract] A single-channel broadcasting radio network is proposed for continuous control of data transmission by reception of relayed signals. Such a system functions effectively in regional computer center networks under non-steady load conditions with much reduced quantization time, if the frequency band is efficiently utilized, radio network resources are appropriately accounted for, and optimum accessibility to all subscribers and adaptive control of message fluxes are ensured. Two situation (rules for selecting control actions according to current requirements) algorithms have been developed at the Institute of Cybernetics (UkSSR Academy of Sciences), one of competitive control and one of adaptive-prioritizing control in queuing systems, which provide these features. The second one has been programmed for the DISKRET experimental batch-type data transmission radio network at the UkSSR Academy of Sciences serving as part of the AKADEMSET' computer center network. Figures 1; references 4: 3 Russian, 1 Western in translation.

[268-2415]

UDC 621.372.83

OPTIMUM DIMENSIONS OF WAVEGUIDE COUPLING LOOP WITH BUILT-IN LONGITUDINALLY DISTRIBUTED P-I-N STRUCTURES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 27 Nov 80) pp 75-77

USOV, N. Yu.

[Abstract] Coupling loops with built-in p-i-n structures are used in microwave devices with power compounding. The optimum design of such a coupling loop ensures a maximally flat frequency characteristic of crosstalk attenuation at zero control current $C(f,0)$, which requires a close to $\pi/2$ phase shift at the connecting points. With the height-to-width ratio $b/a < 0.15$, the shape of the $C(f,0)$ curve almost does not depend on the length (narrow wall) and the necessary height is determined by the thickness and the spacing of the p-i-n structures. The fringe capacitances at the connections can be rendered negligible, moreover, by the proper choice of dimensions. The design process is most expediently begun by calculating the width and the critical frequency of the loop corresponding to the minimum drop of crosstalk attenuation over the operating frequency range. A controllable wideband coupling loop consisting of two p-i-n structures with a 400 micrometer thick i-region built into the E-plane between two rectangular $8 \times 17 \text{ mm}^2$ waveguides was designed according to this procedure for operation in the 12-16 GHz frequency band and prototypes of the loop were tested. The frequency characteristic of crosstalk attenuation was measured at various control current densities and it was found possible to regulate the crosstalk attenuation over a 20 dB range. Figures 5; references: 5 Russian.

[93-2415]

UDC 621.372.832

WIDEBAND DIRECTIONAL COUPLERS BUILT WITH LUMPED ELEMENTS

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82 (manuscript received 12 Feb 81) pp 70-73

SHLEYE, V. R., VORONIN, M. Ya. and DENISOV, A. N.

[abstract] Wideband directional couplers are shown which consist of two transmitting four-pole networks connected through coupling four-pole networks with

a horizontal plane of symmetry. Each four-pole is a II-network or III-network with any combination of lumped shunt and series inductances and capacitances. The design of such directional couplers reduces to selection and design of equivalent admittance inverters. They have characteristic phase shifts independent of the frequency, their nonideality is caused by strongly frequency-dependent reactive admittances. Their performance characteristics such as transfer ratio, as well as directionality and matching, are determined by the phase relations and the scattering matrix coefficients. Numerical design and performance data are given for decimeter-wave directional couplers built in the hybrid-integrated version: meanders formed by very short ($<\lambda_0/8$) lines as series inductances, K 10-9 condensers as series capacitances, open loops with low characteristic impedance as shunt capacitances, and shorted loops with high characteristic impedance as shunt inductances. Figures 4; tables 1; references: 9 Russian.
[280-2415]

UDC 621.396.6.002:621.9.048.6

ULTRASONIC CAVITATION PROCESS OF CLEANING PRINTED-CIRCUIT BOARDS OF SOLUBLE CONTAMINANTS

Minsk VESTSI AKADEMII NAVUK BSSR: SERIYA FIZIKA-TEKHNICHNYKH NAVUK in Russian No 2, Apr-Jun 82 (manuscript received 4 Nov 81) pp 103-106

ALEFIRENKO, V. M., TYAVLOVSKIY, M. D. and FASTOVETS, Ye. P., Minsk Institute of Radio Engineering

[Abstract] The principal contaminant of printed-circuit boards is residue of rosin fluxes soluble in organic and inorganic solvents. The process of cleaning by ultrasonic cavitation can be analyzed theoretically with the aid of the equation of convective diffusion with cavitation
$$\frac{\partial c}{\partial t} + V_x \frac{\partial c}{\partial x} + V_y \frac{\partial c}{\partial y} = D \frac{\partial^2 c}{\partial y^2}$$

(c- concentration of residue, t- time, V_x and V_y tangential and normal components of stream velocity toward interface, D- diffusion coefficient), considering that the rate of mass transfer $\frac{\partial c}{\partial t}$ decreases during the starting transient from

initial maximum to zero in steady state while the thickness of the diffusion layer within microregions decreases periodically. On this basis is derived a relation for cleaning time and process intensity under conditions of constant ultrasonic power supply and uniform cavitation field distribution in space. This relation has been checked experimentally with equipment consisting of a 20 kHz ultrasonic generator, a vat with spherical rosin particles $4 \cdot 10^{-3}$ m in diameter, and a pumping system capable of producing macrostreams as well as cavitating microstreams of solvent mixture (95% Freon + 5% alcohol). Both macrostream velocity and cavitation pressure were measured. In absence of cavitation the dissolution rate constant reached its maximum as the velocity of convective macrostreams increased to 0.8 m/s and then decreased again at higher macrostream velocities. This departure from theory is attributable to eddies

induced by rosin particles causing separation of the boundary layer and thus inhibiting the dissolution process. In the absence of macrostreams, on the other hand, the molecular cavitation dissolution rate constant increased monotonically with increasing cavitation pressure. Under simultaneous action of convective mainstreams and cavitating microstreams the resultant dissolution rate constant follows a composite trend which depends on the ratio of macrostreams to microstreams. Optimum conditions, for maximum dissolution rate, have been established at macrostream velocity of 1 m/s and cavitation pressure of 100 Pa. Figures 3; references: 5 Russian.
[281-2415]

COMPUTERS

UDC 621.382.82.993

COST EFFECTIVENESS OF CORRECTIVE CODES IN LARGE-SCALE INTEGRATION OF MEMORY DEVICES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 2 Feb 81, after revision 28 Apr 81) pp 85-87

URBANOVICH, P. P.

[Abstract] As the degree of large-scale integration is increased, the acceptable production yield of memory devices decreases and consequently the unit cost increases. One remedy, which will make defective LSI memory chips acceptable and more reliable, is the use of corrective codes with the addition of redundant elements in the data processing and storage system. Here the cost of LSI memory chips with and without redundancies is analyzed comparatively, considering both as produced by the same technology: either bipolar or MOS (ratio of chip treatment cost to memory assembly cost 0.8 and 0.25, respectively). With the density of structural and photolithographic defects based on Bose-Einstein statistics and with a Poisson distribution of the acceptable production yield, the cost effectiveness of corrective codes with redundancies depends on the rejection rate and on the number of defects. For every value of the generalized parameter $D \cdot S$ (D = overall defect density, S = surface area) there is an optimum number of defects whose correction will be most cost effective. The cost effectiveness of redundancies in chips smaller than 30 mm^2 does not depend on the cost of the semiconductor wafer. Figures 1; references 8: 5 Russian, 3 Western.
[276-2415]

UDC 621.315.623:620.174

DETERMINING MECHANICAL STRENGTH OF PORCELAIN ISOLATORS FROM ACOUSTIC EMISSION CHARACTERISTICS

Moscow ELEKTRICHESTVO in Russian No 5, May 82 (manuscript received 3 Jun 81)
pp 50-52

ARONSHTAM, Yu. L., candidate of technical sciences; KARPOVA, G. I., engineer; PODOL'SKAYA, G. V., engineer; FREYEROV, V. O., engineer; and KHARIN, A. S., engineer, All-Union Scientific Research Institute of Electrical Power Engineering and Scientific-Industrial Association "Elektrokeramika"

[Abstract] The feasibility of determining the flexural strength of porcelain isolators by the acoustic emission method has been established experimentally by testing 100 glazed and unglazed $10 \times 20 \times 200 \text{ mm}^3$ porcelain beams as well as 68 KO-110-1250 and IOS-100 isolators. Data were obtained on the dependence of the cumulative number of acoustic pulses and of the acoustic emission intensity on the stress, prior to crushing. An evaluation of the data by the method of least squares, also by regression and correlation analysis, indicates a linear trend of this dependence prior to fracture. The coefficient of correlation between stress at fracture and stress at crushing varies from 0.76 to 0.85, the slope of the regression curve varies from 0.9 to 1.08, and the threshold stress varies from 10 to 27 MPa. From these data integral curves of fracture force and crushing distributions have also been obtained. In a practical application of the acoustic emission method to isolators there must also be taken into account the possibility of defects in metal flanges and in binding cement. Figures 4; tables 1; references 5: 4 Russian, 1 Western.
[267-2415]

ELECTROMAGNETIC COMPATIBILITY

UDC 537.874.6

MULTIPLE DIFFRACTION OF SEMIPLANES

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 17 Dec 79) pp 699-705

KALOSHIN, V. A.

[Abstract] A 1975 work by the author demonstrates that the scattering diagram of a plane wave at three semiplanes can be expressed by means of a scattering diagram of a cylindrical wave at one and two planes. The present work examines the successive diffraction of an electromagnetic field at a semiplane. It is shown that in the case of a random number of semiplanes, the scattering diagram of a plane wave is expressed through a combination of solutions for a field of cylindrical waves scattered by a smaller number of semiplanes. Corresponding expressions are presented. It is also shown that the solution for the field of cylindrical waves scattered by an odd number of semiplanes, the edges of which, the semiplanes, the source and point of observation are found on one straight line, is also expressed through a combination of the solutions for a field scattered by a smaller number of semiplanes. An explicit solution is presented for the case of three semiplanes. The problem is also considered of diffraction at n parallel equidistant semiplanes, orthogonally straight, connecting their edges. The author thanks V. A. Borovnikov for useful discussions. Figures 3; references: 7 Russian.

[300-6415]

UDC 621.385.6

THEORY OF PARAMETRIC GENERATION AND AMPLIFICATION OF ELECTROMAGNETIC WAVES IN ELECTRON FLUXES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 20 Aug 80) pp 61-66

DRAGANOV, A. V., KALMYKOV, A. M. and KOTSARENKO, N. Ya.

[Abstract] A theory of parametric generation and amplification of electromagnetic waves in an electron flux is constructed from the short single-term first-order differential equations for the amplitudes of interacting two oppositely traveling waves, the signal wave and slow space-charge wave, taking

into account the presence and depletion of a pumping wave. This theory yields the wave intensity distribution over the interaction space and the dependence of the signal wave intensity on the length of the interaction space at a fixed pumping wave intensity as well as on the retardation of the pumping wave. The conditions for starting, steady-state generation, and amplification are established on the basis of the solution to the equations of this theory, assuming an invariable velocity of the electron flux along the interaction space. Instability of the three-wave interaction here is found to be convective so that oscillations at both signal wave and slow wave frequencies can be amplified. Generation requires a positive feedback provided, for instance, by reflection of the signal wave. Figures 4; references 6: 5 Russian, 1 Western.
[93-2415]

PROBLEMS IN ANALYZING AND OPTIMIZING CHARACTERISTICS OF MULTICAVITY KLYSTRONS BY METHODS OF THEORY OF PLANNED EXPERIMENT

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 24, No 10, Oct 81 (manuscript received 7 Jul 80) pp 52-61

ZHELEZOVSKIY, B. Ye., KOZEL', B. L., PETROV, D. M. and YASNOVA, N. N.

[Abstract] Methods based on the theory of planned experiments are applied to engineering analysis and design optimization of microwave devices such as multicavity klystrons, where tradeoff between precision and simplicity of approximate solutions with all variables taken into account is usually called for. The basic objectives here, as in any multivariate problem, are to extract the significant factors for further consideration and to find a point in the factorial space at which the response functions satisfy all requirements and constraints. A factorial planned experiment eliminates the need for iterations where the response functions are noncorrelated and their sought ranges may not overlap. This is demonstrated on a factorial plan for a six-cavity klystron with a nonuniform large-signal amplitude-frequency characteristic over a given operating frequency range. The experiment is set up with 15 factors, three groups of four (Q-factors, frequency deviations, lengths of drift spaces) and one group of three (power input to first cavity, maximum amplitude and nonuniformity index of amplitude-frequency characteristic at output of last cavity), adequate for generalizing the problem. Independent estimates can be ensured and variation intervals can be established by such techniques as the Hartley plan. Construction of tradeoff optimization solutions in the form of simple explicit relations between variables in two-factorial planes, construction of optimizing adjustment curves, and search for optimum output characteristics by the method of steepest descent are some of the techniques applicable here and easily implemented on a computer. Figures 6; references: 12 Russian. [93-2415]

HIGH-POWER OSCILLATOR TUBES FOR RADIO BROADCASTING, RADIO COMMUNICATION AND TELEVISION

Moscow ELEKTROSVYAZ' in Russian No 5, May 82 pp 17-19

PROKOF'YEV, V. D.

[Abstract] A major trend in development of radio broadcasting, radio communication and television equipment is toward oscillator tubes with higher power output. The latter can be achieved by better antiemission coating of metallic grids or making grids of pyrolitic graphite rather than metal, by improving the cathode configuration and the quality of cathode material, by more economical plate cooling, by computer-aided design of new electron-optical systems, by suppression of parasitic microwave emission, by use of cermet for large component assemblies and the elimination of the need for precious rare materials. Upon implementation of these measures, it is expected that tetrodes with power ratings of 100-1000 kW at 30 MHz will become available during the 11th Five-Year-Plan period. They will include carrier-frequency tetrodes for short-wave radio broadcasting (100, 250, 1000 kW) and long-wave radio broadcasting (150, 300, 1200 kW) with 100% plate or plate-screen modulation, linear tetrodes (250-300 kW) for radio communication, and television tetrodes (1.5-2 kW, 470-960 MHz). Major problems in development of these devices are reliability and long life, as well as protection against environmental hazards. This can be ensured by maintaining stability of filament power rather than only filament voltage within 1-2%, providing for slow rather than fast filament heating, building in sufficient electrical strength, cooling with pure water to avoid scale formation, assembling tubes in dust-free production facilities, high-voltage pre-aging of tubes before installation for service, and periodic rinsing of plates with 10% vinegar solution. An important item to consider in production and operation of power tubes is their reconditioning for further use after their emission capacity has been depleted and salvage of reusable parts from scrapped units.

[229-2415]

UDC 621.382.233

EFFECT OF SKIN EFFECT ON TEMPERATURE OF FORWARD BIASED p-i-n DIODE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 9 Feb 81, after revision 27 Jul 81) pp 51-55

BOVA, N. T. and MALYUGA, V. F.

[Abstract] The equation of heat conduction is solved for a p-i-n diode with forward bias and microwave power input. A right circular cylinder of radius R and height h equal to the thickness of the depleted i-region serves as a thermal model of this device without convective and radiative heat transfer. The lateral surface is thermally insulated with a protective coating or a ceramic housing, the initial temperature of the device is constant. Two variants are considered: lower base thermally insulated and upper base joined in a radiator as heat sink, or both bases joined to radiators. In each case the solution yields the temperature rise as a function of the skin effect in the form of a fast converging series in Bessel functions. Next is calculated the

maximum temperature rise in the quasi-steady state after many power input pulses (number of pulses approaching infinity in the case of a high-frequency signal), in the worst case of a transient period longer than the pulse repetition period and not shorter than the interval between pulses. A comparison with experimental data pertaining to microwave p-i-n diodes with 75°C temperature rating indicate that the skin effect can be disregarded at lower frequencies and low electrical conductivity. Figures 3; references 14: 8 Russian, 6 Western.
[276-2415]

UDC 621.385.6:778.3

PHOTOGRAPHIC-PHOTOMETRIC METHOD OF MEASURING ELECTRON BEAMS WITH HIGH POWER DENSITY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 25, No 5, May 82 (manuscript received 12 Jan 81) pp 38-42

BALAKLITSKIY, I. M., BELOUSOV, Ye. V. and KORZH, V. G.

[Abstract] A method of determining the parameters of thin (ribbon-like) electron beams with high power density is described which utilizes optical radiation emitted by the surface of a metal target. The intensity as well as shape and size of the light spot are determined by the power density distribution over the cross section of the incident electron beam, the relative intensity depending linearly on the current density at a fixed accelerating voltage. A diode-type electron gun generating ribbon beams with magnetic confinement for diffraction radiation generators and a copper target with water cooling were used for an experimental evaluation of this method. Photographs of light spots were measured on an IFO-451 microphotometer bench. By processing the data with the use of appropriate scale and conversion factors, as well as exposure indexes, the current density distribution over an electron beam cross section as well as the amplitudes of static beam fluctuations in the plane of the target at various accelerating voltages were determined from the geometrical dimensions of light spots, in two typical cases of peaking and flat current density distributions respectively. The photographic film in this method can be replaced with any other kind of photoreceiver. Figures 1; references 8: 6 Russian, 2 Western in translation.
[276-2415]

EFFECT OF INTRINSIC ELECTRIC CHARGE CARRIED BY AIRCRAFT ON INITIATION OF LIGHTNING

Moscow ELEKTRICHESTVO in Russian No 5, May 82 (manuscript received 24 Nov 80)
pp 63-64

NESTEROV, Ye. V., candidate of physico-mathematical sciences, and
TEYMURAZOVA, V. A., engineer, Moscow

[Abstract] The effect of intrinsic unipolar charge which an aircraft acquires on the initiation of lightning is estimated on a basis of the expression for the electric field intensity E_x , the otherwise uniform field being distorted here by an oblong ellipsoid with a ratio of semiaxes $b/a \approx 0.1$ simulating the fuselage and with the wings disregarded. The length of the leader channel, in absence of corona, is estimated from the energy of a capacitor and the ionization energy. Numerical calculations yield $L = 10-20$ m for a relative concentration of ionizing molecules in air within the 0.5-1 range and an air ionization potential of 14 eV. These results agree with results of experimental model studies reported elsewhere. Figures 1; references: 4 Russian.
[267-2415]

INSTRUMENTATION & MEASUREMENTS

MEASUREMENT EQUIPMENT

Moscow RADIO in Russian No 2, Feb 82 pp 35-36

BOGDAN, A.

[Abstract] The 30th All-Union Exhibition of the Creativity of Radio Amateurs-Designers included a section on radio measurement apparatus. Some of the more interesting devices are briefly described, including a television signal test level meter and color bar generator; miniaturized measurement devices; an oscillograph; an audio frequency and ultrasonic signal generator; a standard measurement signal generator; a digital frequency meter operating in the 10 Hz to 200 MHz band with signals of any shape and amplitude of at least 75 mV; a 15 MHz oscilloscope; a miniprocessor based on a BZ-24 calculator; and several digital multimeters.

[205-6508]

UDC 53.08:621.875.4:65.011.8

WAYS TO IMPROVE CLASS-2 REFERENCE TURNTABLES

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 50-52

ARTYUKHOV, Ye. A. and ELINSON, L. S.

[Abstract] Accelerometers are checked in the low range (0-1 g) on turntables for varying the orientation of the instrument axis relative to the earth's gravitational field. Goniometers used with this equipment are characterized by long-period (2π) errors and short-period ($2\pi/p$, π/p) errors (p -electrical reduction ratio in tracking system = number of pole pairs in transducer), the former essentially caused by imprecise alignment of transducer-receiver rotor relative to rotating modulator and the latter essentially by parasitic coupling between useful signal and reference signal. A precision goniometer turntable has been designed in which these errors are minimized by use of a multipole vernier angle transducer. It includes a coarse tracking system with a servomotor and mismatch-signal amplifier and a fine tracking system with inductive phase transducer-receiver and correcting phase shifter. Its performance characteristics indicate the feasibility of automation and use as class-2 reference equipment with UIF-2 goniometers (error within $\pm 1''$). Figures 2; references:

1 Russian.

[277-2415]

IMPROVING ACCURACY OF FUNCTIONAL ANGLE TRANSDUCERS IN MOTION DUPLICATING SYSTEMS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 52-54

BLANTER, B. E., KRIVTSOV, Ye. P., FILATOV, Yu. V. and YUDIN, A. M.

[Abstract] Functional angle transducers, unlike linear ones, have a variable scale so that an output signal can be obtained which is some given function of the angle. A ring laser is used for drawing and checking the scales of such transducers; but it must have excellent metrological characteristics. The laser signal passes through a counter-divider to a servomechanism with a tool which draws or tracks scale markers on the drum or disk of a magnetic transducer coated with ferromagnetic film or on the disk of a photoelectric transducer coated with light-sensitive film. High resolution can be achieved without a high-speed large-memory control computer by the method of graduation which utilizes frequency modulation and beating of the laser signal during complex motion of the ring laser as, for instance, rotation about two independent axes. An analysis of the speed-frequency relation reveals that two types of functional angle transducers can be produced in this way, namely sine-cosine and linear-harmonic ones. Certain conditions must be satisfied, but there is also a possibility of further modulation to produce new classes of scales. Figures 3; references: 6 Russian.
[277-2415]

ERROR ANALYSIS OF METHODS OF ANGLE SETTING

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 54-55

KRIVTSOV, Ye. P.

[Abstract] Two methods of angle setting in the production of angle transducer scales are analyzed comparatively for accuracy. Both methods are based on use of a ring laser as a reference angle transducer. In the first method the ring laser and scale blank are rotated coaxially, the main sources of error being discreteness of angle variation and rotation of the earth. In the second method the scale blank is also rotated relative to the servomechanism with a marking tool, the main sources of error being rotation of the earth and instability of the angular velocity of turntables as well as their oscillations relative to axes perpendicular to the axis of rotation. The first method is somewhat more accurate, but the only way to improve it further is to increase the scale factor of the ring laser. Figures 2; references: 4 Russian.
[277-2415]

METHOD OF IMPROVING ACCURACY OF FORCE MEASURING ELECTROMAGNETIC ACCELEROMETER SUSPENSION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 48-49

D'YACHKOV, V. Ye.

[Abstract] Regulating the magnetic induction in the gap between electromagnet and sensor in the accelerometer suspension has been proposed by V.M. Kushul' et al (USSR Patent disclosure No 824062, 1981) for improving the accuracy of such force transducers. The regulating system consists of a dynamic corrector, a subtractor, an adder, a reference-voltage source, two comparators, two integrators, two amplifier-converters, and two induction transducers. The performance of this system is based on the linear dependence of dynamometer force on control voltage and depends on the precision of circuit components, especially critical being the accuracy of the induction transducer. Figures 1; references: 4 Russian.

[277-2415]

CLASS-1 REFERENCE-STANDARD TEST STAND FOR CHECKING PIEZOELECTRIC ACCELEROMETERS OF IMPACT ACCELERATIONS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 82 pp 45-46

KARASEV, S. N.

[Abstract] A class-1 reference-standard test stand has been made available for checking piezoelectric accelerometers over the 10^3 - 10^6 m/s² range under an impact of 25-400 microsecond duration. It consists of an induction coil and a mechanical waveguide, a horizontal tube with a piston inside which carries the accelerometers. Impact is produced by electromagnetic forces which the induction coil generates when energized. The coil is connected in series with a thyatron and a capacitor, the former fired through a controlled pulse transformer and the latter charged through a controlled rectifier. The pressure in the waveguide is proportional to the velocity of air particles in a wave (also to the density of air and the speed of sound in air) and the acceleration at the piston is equal to the rate of change of this velocity. Voltage output signals from tested accelerometers are recorded on an oscillograph, which has been triggered in synchronism with the thyatron, and are compared with the output voltage of a reference a.c. generator read on a V7-27 voltmeter. Many existing accelerometers thus tested were found either not to withstand accelerations up to 10^6 m/s² or to have highly nonlinear amplitude characteristics. Figures 1; tables 1; references: 4 Russian.

[275-2415]

VIBRATIONAL ERRORS OF DIGITAL ACCELEROMETERS WITH CURRENT-TO-CODE CONVERTERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 44-48

KONOVALOV, S. F.

[Abstract] Accelerometers with current-to-code converters are widely used in inertial navigation systems because of their high accuracy. These instruments are built in two versions, one operating with pulse current from the torque transducer and one including a converter with an integrating capacitor. Each can be designed to operate with pulse-width or relay-pulse modulation. Here the response of these accelerometers to the vibratory perturbation at the input is analyzed on basis of given accelerometer structure and known quantizer characteristic. The results reveal that vibrational error does not build up, because of the stroboscopic effect, that the maximum error is smaller and the scale conversion time is shorter in the case of pulse-width modulation, and that critical damping minimizes the vibrational error of these accelerometers with either type of modulation. References: 4 Russian.
[277-2415]

ERRORS IN CHECKING OF LINEAR FLUIDIC ACCELEROMETERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 55-57

DUBASOV, V. V., SINEL'NIKOV, A. Ye. and SHKOL'NIK, B. A.

[Abstract] Linear fluidic accelerometers are suitable for measuring low-frequency linear accelerations, but methodological errors in checking them on turntables have not yet been studied. In the present report the accuracy of checking them is analyzed on a basis of the appropriate equation of motion in the steady mode at accelerations larger than that of gravity and in the typical case of linearly increasing acceleration. The solution, obtained by successive approximations, has been evaluated numerically on a computer by the Hamming method. The results indicate that these accelerometers can be checked accurately on a dual centrifuge, but reproducibility of accelerations must be checked numerically for each operating mode. Figures 1; references: 4 Russian.
[277-2415]

REFERENCE SOURCE OF INFRARED RADIATION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No. 5, May 82 pp 35-36

VLASOV, L. V., YELISEYEV, V. B., YERMILOV, A. N., LIBERMAN, A. A., OSTAPCHUK, S. N., SAPRITSKIY, V. I. and SPIGLAZOV, A. N.

[Abstract] A black-body model is proposed as a reference source of infrared radiation. It is essentially a coaxial heat pipe with a small ratio of aperture radius to cavity depth. A heater-evaporator coil wrapped in thermal insulation is wound around a cylindrical shell closed at one end and open at the other. The inside surface of this shell is lined with a capillary structure for circulating liquid sodium (800-1200 K) as a heat carrier around a coaxial cavity serving as a condenser with a cylindrical radiator slug in the middle. The structure is designed to ensure an almost perfectly uniform temperature distribution, with a special compartment for a temperature transducer or optical pyrometer. Two experimental prototypes of such a device have been tested and calibrated with a differential Pt/PtRh thermocouple, both with the radiator slug made of stainless steel: one annealed at 1400 K for 8 h and one without heat treatment. The radial temperature profile is uniform within 0.1 K, the axial temperature profile is a linear one with the temperature increasing from the bottom to the open end by less than 0.5 K at 800 K and less than 0.2 K at 1200 K. The emissivity was determined both theoretically and experimentally for the two models at three wavelengths (0.63, 1.15, 10.6 micrometer), the total error not exceeding 8%. Calculations with and without the temperature gradient taken into account yielded values of emissivity differing by 0.00005 (annealed radiator slug) and 0.0001 (unannealed radiator slug) only. Measurements were made by the reflection method with an integrating sphere. Figures 2; tables 1; references 4: 2 Russian, 2 Western. [275-2415]

UDC 536.52:635.317.2:681.7

METHOD OF DESIGNING OPTICAL SYSTEMS FOR BRIGHTNESS PYROMETERS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 57-59

KOGAN, A. V. and SHERSTYUKOV, N. G.

[Abstract] A method of designing the optical system for a brightness pyrometer is shown which is based on the frequency-contrast characteristic and the "point" scattering function as criteria. A uniform sinusoidal or cosinusoidal grating serves as the model test object whose temperature is to be measured. The luminance of its geometrical image varies from B_{\max} to B_{\min} , that of its real image varies from B'_{\max} to B'_{\min} , and an additional design constraint is $B_{\max} \gg B_{\min}$ ($B_{\min} \approx 0$). Effects of diffraction and defocusing are taken into account in calculation of the error due to aberrations, the pyrometer performance characteristics depending also on the radiation wavelength and the

grating period. Design and error analysis yield relations for the maximum allowable aberration for required measurement accuracy. The results are applied to pyrometers "Smotrich-3" with a three-lens objective (fluorite-glass-fluorite) and PChD-131-01 with single-lens or two-lens objective, using a long strip or a circular disk as test object at temperatures up to 2273K. Figures 3; references 6: 5 Russian, 1 Western in translation.
[277-2415]

UDC 536.521:666.1.031.13

SELECTIVE-ABSORPTION PYROMETER FOR MEASURING TEMPERATURE OF GLASS DURING GLASS MAKING PROCESS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 59-61

KOROBKO, I. M.

[Abstract] Measuring the temperature of less than 0.5 mm thick glass layers inside glass ingots during the glass making process requires a pyrometer sensitive only to radiation in the 4-8 micrometer range, within which glass has the characteristics of a black body. A selectively absorbing pyrometer has been designed for this purpose which contains an optoacoustic receiver, a hermetically sealed device with a leucosapphire "window" filled with gaseous carbon dioxide. The pyrometer tube is filled with nitrogen and has cellophane "windows", it contains a Teflon shutter driven by a synchronous motor. The instrument also includes protective filters made of synthetic sapphire, a condenser microphone, a cathode follower, an RC voltage amplifier, a 2-stage power amplifier with negative feedback in the second stage, a silicon-diode rectifier, a transducer, a secondary thermometer, a power supply with stabilitrons, and a reference heater element. The temperature range of this instrument is 300-1200°C, its sensitivity is at least 0.1% and its error does not exceed $\pm 1\%$. The time constant of the transducer is 150 microsecond. Its maintenance-free life is 12 months. Figures 3; references 2: 1 Russian, 1 Western.
[277-2415]

UDC 621.2:621.317.4

STATE OF ART AND DEVELOPMENT TRENDS IN MAGNETIC MEASURING APPARATUS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 82, pp 61-64

SKORODUMOV, S. A., TRET'YAKOV, L. M. and YAKOVLEV, N. I.

[Abstract] Industry-wide demand for magnetic measurements, specifically of magnetic induction, is compared with commercially available instruments including gages and accessories. An analysis of ranges, sizes and accuracy indicates a need for extending the capabilities of instruments to 10 T (constant magnetic fields), to 2 T and beyond 500 kHz (alternating magnetic fields), and to the 2-343 K temperature range. There is also a need for improving both quality

and reliability of the instruments, development of smaller sizes for measurement of field nonuniformities within volumes of 1 mm^3 or smaller, and raising the level of automation with adequate interfacing with computers. A particularly important application is contactless inspection and diagnosis of integrated circuits in electronic equipment and electrical machinery in power equipment, in both case by measurement of the electromagnetic field scattered by equipment components during operation. The first instruments for this purpose include models F7079 and F7089, also model Shch4315-03, manufactured since 1981 by enterprises of the USSR Ministry of Instruments, Means of Automation and Control Systems Production. Tables 4; references: 2 Russian. [275-2415]

UDC 621.3.027.8:389.14

HARDWARE FOR UNIFIED MEASUREMENTS IN PRODUCTION OF HIGH-VOLTAGE INSTRUMENTS FOR TRANSFORMER CONSTRUCTION

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 5-7

ZHURAVLEV, E. N., KOPSHIN, V. V., KILEVOY, V. K., KIKALO, V. I., MISHUK, T. V. and REVIN, L. G.

[Abstract] A complex of high-precision reference standards for certification of high-voltage transformer instruments has been developed by the All-Union Scientific Research Institute of Metrological Service and its Ukrainian Center, jointly with the "Zaporozhtransformator" industrial association and the All-Union Institute of Transformer Design, as part of the program of establishing a unified power system in the USSR. The instruments include a DVINA set of differential d.c. voltmeters for measurements by the differential method with aid of voltage stabilizer and current stabilizer connected in series at an operating current of 5 microampere, DVINA-10, 100,400 models with respectively ± 12 , ± 120 , ± 400 kV ratings and 0.01-0.03% accuracy, special-purpose multiple-range voltage-ratio meters and scale converters. There have also been built a high-precision test stand for checking these instruments and for transferring the volt etalon to the 110 kV - 50 Hz class of a.c. instruments, and a transportable laboratory for testing potential transformers and kilovoltmeters with ratings up to 35 kV. A set of reference potential transformers TNO-110,220,110/220 kV of class 0.1 accuracy is available already. While DVINA ± 800 kV d.c. reference standards with 0.03% accuracy are being completed and will serve as base for extending the range to 1500 kV, further studies will be made soon concerning reference standards for 500/575 kV - 50/60 Hz.a.c. instruments and extension of the range here to 1150 kV. References: 11 Russian. [277-2415]

MODEL LV-3M LASER VISOR

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 82 pp 43-44

MOROZOVA, S. P., MOROZOV, P. A., CHAVUSER, G. Sh., KORNEVA, T. G. and MALYSHEVA, T. P.

[Abstract] A laser visor for measuring power density and energy distributions across laser beams is described which consists of a receiver camera with or without a confocal optical attachment containing interchangeable oculars, an electronic indicating instrument, and a power supply. Optical components of this LV-3M device include a telescope, a radiation receiver, a parabolic coupling mirror, an oscillating plane mirror and a rotating octahedral drum mirror for vertical and horizontal scanning, respectively. Frame and line sweeps are designed for image resolution into 100 lines per 62.5 microsecond at a 12.5 Hz repetition rate. Electrical components of this LV-3M device include a pre-amplifier, amplifiers of frame and line synchronizing pulses from two transmitters and two receivers, a d.c. restorer built with series 1KT011A and 1UT531A microcircuits and accurate within 1%, a variable-gain video amplifier with attenuator, an isolevel forming circuit (amplitude discriminator with regulation of lower and upper levels) built with series K554SA1 comparator microcircuits, and a summator in which the video signal as well as the isolevels and intensifier pulses for the electronic raster are shifted by means of switches consisting of 2P302B field-effect transistors controllable by gate pulses from 1UT401B operational amplifiers. The spectral range of the device is 9-11 micrometer, the minimum recordable power density is $3 \cdot 10^{-6}$ W/cm² without optical attachment and increasingly higher with optical attachment as the signal-to-noise ratio decreases. Its dynamic range is 20 dB, it can operate continuously for 1 h from a 220V+10%-50Hz+1% Hz power line and its parameters remain stable within the 10-50°C temperature range. Figures 3; references: 3 Russian.
[275-2415]

MODERN TRENDS IN DESIGN OF COMPENSATING ACCELEROMETERS WITH DISCRETE OUTPUT

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 41-45

SKALON, A. I.

[Abstract] Two methods are now used for producing a digital accelerometer output signal, namely analog-to-digital conversion (voltage-to-code or current-to-code) and closed-loop feedback. A/D converters are built with periodic integration of voltage or current by means of a capacitor and compensation of stored charge by stabilized constant current or by current pulses. The major problems here are providing a wide range while minimizing the output pulse scale, which is done by dividing the entire range into subranges with variable

quantization steps, and matching A/D converter to accelerometer without degradation of accuracy and dynamic range. The method of pulse feedback is free of these drawbacks, pulse-frequency pulse-width modulation being preferred. Feasibility studies are in progress concerning use of optoelectronic components for such accelerometers. A typical example is a displacement transducer based on two LED-photoresistor pairs with appropriate threshold and switching elements. Figures 3; references 13: 12 Russian, 1 Western.
[277-2415]

UDC 621.391.8:681.3

METHOD OF SPECTRAL ANALYSIS OF INFRALOW-FREQUENCY PERIODIC SIGNALS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 5, May 82 pp 19-21

ISMAILOV, Sh. Yu., ABDULLAYEV, I. M. and MAMEDOV, N. Ya.

[Abstract] A digital method of spectral analysis of infralow-frequency signals is proposed which uses algorithms of Fourier transformation but eliminates the need for generating discrete values of orthogonal functions and multiplying them by digital readouts. The method is based on intraperiod measurements and subsequent digital processing of instantaneous values with a variable discretization step which depends on the order of a given harmonic. The complex Fourier coefficients are calculated through solution of a system of linear algebraic equations with a triangular transformation matrix of 0 and 1 elements only. The digital analyzer for implementing this method consists of an $f(t)$ signal meter, a readings distributor, a bank of adders, a programmable control module, a computer, a timing-command module, a distributing-command module, a command module for assigning the algebraic sign of $(-1)^i$ in summation of instantaneous values, a command module for computing complex Fourier coefficients, a display screen, and a command module for data display. Figures 1; references: 4 Russian.
[275-2415]

NEW MEANS OF MEASUREMENT

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 76-77

[Abstract] Recently certified and now available instruments include the SP-67 mercury-glass thermometer for measuring ambient temperatures from -30 to $+45^\circ\text{C}$ for the M-27M optomechanical magnetometer; the DRD-0.4/4.0 acrylic dosimeter for monitoring the radiative sterilization of medical instruments and other radiative technological processes; the F 4372 universal instrument with cathode-ray display for measuring direct and alternating currents (1 mA - 10A) and voltages (100 mV - 1000 V), ohmic resistances (1 kohm - 10 Mohm), frequencies (10 kHz - 50 MHz) and other electric signal parameters, as well as for plotting amplitude-frequency characteristics of resonant systems in electron devices and acoustic devices under laboratory, industrial and service conditions; the 4323A

universal analog instrument for measuring direct and rms alternating (sinusoidal) currents (50 microampere - 500 mA) and voltages (50 mV - 500 V), ohmic resistances (500 ohm - 5000 kohm), and for indicating the trend of changes of a variable quantity; the VL2 vibration-proof dosimeter for measuring the density (0.6-1.02 g/cm³) of clear petroleum products such as liquid engine fuels; and PPTP primary transducers for indicating and measuring the flux density of thermal radiation (50-750 kW/m² and 50-400 kW/cm² respectively) in furnaces burning high-power fuels.
[277-2415]

HEAD ORGANIZATIONS FOR GOVERNMENT-MANDATED TESTING OF MEASURING INSTRUMENTS

Moscow IZMERITEL'NAYA TEKHNIKA in Russian No 6, Jun 82 pp 77-78

SHCHEPINA, V. V., All-Union Scientific Research Institute of Metrological Service

[Abstract] In the 1979-80 period USSR Ministerial departments (Ministry of Machine and Tool Industry, Central Scientific Research Institute of Geodesy Aerial Photography and Cartography) and the USSR State Committee on Standards have appointed, respectively 2 and 14 head organizations for government-mandated testing of measuring instruments. These organizations are responsible for certification of instruments and are accountable to the USSR State Committee on Standards. All scientific and procedural guidelines and documentation have been prepared by the All-Union Scientific Research Institute of Metrological Service. The network of head organizations is being further expanded so that all testing of instruments in use will be delegated to ministerial organizations, while those within the Standards system will be exclusively and more extensively engaged in testing high-precision and primary reference instruments.
[277-2415]

MAGNETICS

UDC 621.373

AUTOMATIC PULSE COMPRESSION IN DISTRIBUTED SYSTEM WITH SATURABLE MAGNETIC MATERIAL

Moscow RADIOTEKHNIKA in Russian Vol 37, No 5, May 82
(manuscript received 6 May 81) pp 37-39

MESHKOV, A. N.

[Abstract] A piecewise-homogeneous waveguide is considered with a ferrite occupying part of it. A saturation-magnetization shock wave of rectangular pulse can be generated in such a waveguide with automatically decreasing pulse duration and increasing pulse power, while the pulse energy remains almost constant. This is demonstrated on a typical waveguide with an open end, across which a resistive load is applied after delay while the voltage pulse travels toward it. Calculations reveal automatic compression of the pulse. This has also been confirmed experimentally on oscillograms of video pulses in a non-linear waveguide with characteristic impedance $\rho_0 = 0.5$ ohm, with 0.27VT ferrite rings at one end and with a load $R_L = 0.5$ ohm at other end. Figures 2; references: 5 Russian.
[280-2415]

UDC 681.84.083.84:77.021.16

IMPROVEMENT OF DRYING PROCESS IN MP-2-600 WET COATING MACHINE FOR MAGNETIC TAPES

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 5, May 82 pp 53-56

BOGDAN, N. P., LABUTIN, V. A. and LOBANOV, V. M., Kazan' Scientific Research and Technological Institute of Photographic Equipment Design

[Abstract] In the USSR magnetic tapes are produced with the use of MP-2-600 wet coating machines, which include a three-stage drying process (counterflow, vertical jet, finish drying). A study was made to determine the feasibility of optimizing this process and, at the same time, maximize the recovery of solvents for varnish coating. Experiments were performed at the "Tasma" plant of the Kazan' Industrial Association imeni V. V. Kuybyshev. The three-stage process was replaced with a single counterflow stage along the entire basket, except in the finish drying zone. Temperature variations in the air-vapor mixture

along the basket and surface microroughness along the tape were measured, also specific surface of the tape (with a model 212 Perkin-Elmer-Shell sorption meter). Electroacoustic and mechanical performance characteristics of A4407-6B magnetic tape dried in this way were also evaluated, measurements at 10,000 Hz frequency with model 2305 Brüel & Kjoer recording instrument being particularly informative, and found to be acceptable. The new drying process not only simplifies the construction of equipment, its control and maintenance, but also reduces desiccant and vapor as well as energy consumption to one third. An additional benefit is elimination of air polluting exhaust of noxious organic solvents contained in ferromagnetic-grade varnishes. The option of additional finish drying is available. Already 5 million running meters of high-quality tape have been produced by this process at the "Tasma" plant, at a cost saving of 50,000 rubles annually per machine. Figures 3; tables 4; references 9: 8 Russian, 1 Western.

[278-2415]

UDC 621.372.85

MULTIDIODE MICROSTRIP SWITCH

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 16 Mar 81) pp 44-46

LEBEDEV, I. V., ALYBIN, V. G., KUPTSOV, Ye. I. and TROFIMOV, V. P.

[Abstract] A hybrid-integrated multidiode limit switch has been built on a microstripline by bilateral planar technology. Four or more diodes, components of a slot resonator, are mounted on the conducting base of the line on the back side of the substrate. The conducting strips whose edges form the resonator cavity are placed in a window in the conductive coating. The structure of this device resembles a multidiode resonance grid, except for the series connection of the resonator into the line. The device has been designed with an input impedance at resonance frequency, the maximum possible during cutoff with forward bias and the minimum possible during conduction with zero bias. Prototypes built with 2A-517A diodes on Policor and Teflon-foil substrate, also with d.c. suppressors on the output side, were tested in the decimeter wave band. The experimental data agree closely with predicted theoretical characteristics. Insertion losses within the $0.1 \omega_0$ transmission band in the conduction mode do not exceed 0.3 dB with a VSWR= 1.4, decoupling within the same frequency band with forward bias on each diode exceeding 13 dB. Figures 3; references 6: 5 Russian, 1 Western.
[93-2415]

UDC 621.372.85

INVERSION-TYPE MULTIDIODE RESONANCE GRID

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 16 Mar 81) pp 83-84

AKOPYAN, V. A., ALYBIN, V. G. and LEBEDEV, I. V.

[Abstract] An inversion-type multidiode resonance grid for switching microwave signals operates on the principle that conduction occurs under forward bias and cutoff occurs under zero or reverse bias. Such a grid must have capacitive rather than inductive coupling stubs. Parallel resonance, corresponding to minimum insertion loss, is determined principally by the total length of the rod line. Use of controlled p-i-n diodes ensures wider frequency range and higher power rating. Figures 4; references 4: 3 Russian, 1 Western.
[93-2415]

OPTIMUM REACTANCE OF 'EQUIVALENT' DIODE IN SOLID-STATE MICROWAVE OSCILLATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 15 Apr 80, after revision 27 Jan 81) pp 80-81

MACHUSSKIY, Ye. A.

[Abstract] The optimum reactance of Gunn-effect or IMPATT diode, for matching the negative resistance of such a diode to the high characteristic impedance of the waveguide, is calculated on the basis of the equivalent circuit of a microwave oscillator. Numerical results for such a diode in the waveguide structure of a typical 30 GHz oscillator, obtained on the basis of the equivalent circuit reduced to three parallel branches, agree closely with experimental data. Figures 1; references 5: 4 Russian, 1 Western.
[93-2415]

MICROWAVE GENERATOR OF COMBINATION FREQUENCIES

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 16 Feb 81) pp 69-72

STROGANOVA, Ye. P., IVANOV, Ye. N. and TSARAPKIN, D. P.

[Abstract] A microwave generator of combination frequencies is described which includes both frequency stabilization and frequency control by means of a low-frequency external signal. The control mechanism is based on generation of side frequencies and their locking by the stabilization circuit. The tank circuit consists of a resistance-coupled or impedance-coupled two-stage filter. The dependence of the generator performance characteristics, namely tuning range and stability, on the filter circuit parameters are analyzed on the basis of short equations for the steady state, assuming a noninductive active element. Computer calculations by the Steffensen method for a 70 mW - 14 GHz Gunn-effect diode as the active element indicate that side frequencies will not be locked when the voltage of the external control signal is too low. In order for synchronism at combination frequency to occur in this case, a 200 MHz external signal must be larger than 2 V. Figures 5; references 2: 1 Russian, 1 Western.
[93-2415]

TRENDS IN DEVELOPMENT OF HYBRID AND MONOLITHIC TECHNOLOGIES FOR MICROWAVE AMPLIFIERS BASED ON FIELD-EFFECT TRANSISTORS (SURVEY)

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81)(manuscript received 23 Mar 81) pp 5-17

SHVARTS, N. Z.

[Abstract] Development of hybrid and monolithic technologies specifically applied to microwave amplifiers aims at better construction of active and passive elements, better simulation and measurement of amplifier performance, and circuit design optimization. As active elements low-noise field-effect power transistors based on epitaxial GaAs structures are used, InP being considered for realization of its theoretical advantages. Major improvements in these devices are a shorter gate, lower parasitic resistances, capacitance and inductance, better heat dissipation with better hermetization, and internal matching. Improvements in passive elements include use of 98-100% Al_2O_3 ceramics or GaAs as dielectric substrate material and better methods of depositing thin metal films. Improved simulation and measurement of amplifier performance include correction of errors, compensation of distortions, and elimination of parasitic resonances, accurate determination of the scattering matrix coefficients, and optimization of the model complexity. Design optimization follows these improvements, usually computer-aided and preceded by synthesis on the basis of circuit theory, the requirements being different for narrow-band and wide-band amplifiers especially with regard to linearity and noise. No better alternative to GaAs (InP) devices is expected to be found by the year 2000, but still lower noise levels are foreseen. Advantages of field-effect-transistor and Schottky-barrier-diode logic will inevitably stimulate the trend toward monolithic circuit integration. Specifics and diversity of requirements imposed on microwave amplifiers will not, however, allow hybrid circuit integration to be replaced completely. Both technologies will develop concurrently for the time being. In addition, there may appear quasi-monolithic integrated circuits. Purely monolithic integrated circuits will be found in mass products only, unless this technology develops faster than predicted. Figures 4; tables 3; references 46: 7 Russian, 39 Western. [93-2415]

UDC 621.382.2

PECULIARITIES OF LOW-FREQUENCY OSCILLATIONS IN MICROWAVE GUNN-EFFECT DIODES

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 20 Feb 81) pp 67-69

USANOV, D. A., GORBATOV, S. S. and SKRIPAL', A. V.

[Abstract] The negative differential resistance in a Gunn-effect diode can cause low-frequency oscillations in the supply circuit, which in turn affect

the output characteristics of such a microwave device over a wide range of operating frequencies. These low-frequency oscillations can either be utilized, as for generating self-modulated oscillations, or suppressed if undesirable. Here the phenomenon is described theoretically by the differential equation of oscillations in the equivalent circuit, a nonlinear equation solvable only by a numerical method, and by an approximate fourth-power current-voltage characteristic of the diode. The equivalent circuit of the device consists of five parallel branches: negative differential conductance of diode, capacitance of diode, circuit capacitance, circuit inductance, circuit conductance (resistance). Numerical calculations for a 3A 703B diode are verified by experimental data, namely the dependence of the low-frequency oscillation frequency on circuit capacitance and circuit resistance as well as on d.c. excitation voltage within the range from threshold to cutoff. The results also reveal the transient response to pulse voltage excitation and a voltage hysteresis, the magnitude of which depends nonmonotonically on both circuit resistance and capacitance, with a sharp peak when either one is varied and the other held constant. Figures 4; references 8: 4 Russian, 4 Western (2 in translation). [93-2415]

UDC 621.385.6.01

SPACE CHARGE EFFECT OF ELECTRON FLOW LAMINATIONS IN OROTRONS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 16 Jan 81) pp 787-793

BELYAVSKIY, B. A. and TSEYTLIN, M. B.

[Abstract] A 1980 work by the authors analyzes the operation of an orotron on the basis of nonlinear two-dimensional theory, neglecting the variable component of the space charge field. In the present work it is shown that the nonuniformity of the high-frequency field with respect to the width of the electron beam exerts a significant influence on effective interaction. However, as shown in a 1972 report from the literature, in devices with longitudinal interaction it is also necessary to consider distribution of the space charge field with respect to the cross section of the beam. The present work takes into account the simultaneous effect on the effectiveness of interaction in the orotron of the distribution with respect to the width of the electron beam, both of the external field and the field of the space charge. Two types of periodic structures are considered: 1) A reflecting lattice applied to a flat mirror; and 2) A double-row periodic structure which is a system of pins passable for a high-frequency field. A focusing magnetic field is present. It is shown that nonuniformity of a high-frequency field with respect to the width of an electron beam exerts a considerable influence on the electron efficiency for a system with a single-row structure. Consequently, for a real system with a finite width of the electron beam a larger value of the efficiency can be obtained for a system for a double-row structure which confirms the results of an experiment described in the literature. Figures 4; references: 5 Russian. [300-6415]

MICROSTRIP OSCILLATORS WITH LOWERED RADIATION LEVEL

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 24 Mar 81) pp 77-78

ALESIN, A. M., NAZARENKO, L. S. and SKLYAROV, A. P.

[Abstract] Radiation of electromagnetic waves from a resonator into ambient space degrades the performance characteristics of microwave oscillators built with a semiconductor diode between a microstrip resonator and a microstrip output line. This effect can be abated by special design of the system, which also includes a supply filter and an impedance transformer with narrow resonator slot. Three such configurations were built and then tested in the millimeter wave band: U-shape resonator (100 mW output, relative frequency instability $2 \cdot 10^{-6}$), ring resonator (100 mW output, relative frequency instability $0.5 \cdot 10^{-5}$), straight half-wave resonator (80 mW output, relative frequency instability 10^{-4}). Figures 1; references 5: 1 Russian, 4 Western. [93-2415]

USE OF SERIES K155 MICROCIRCUITS

Moscow RADIO in Russian No 2, Feb 82 pp 30-34

ALEKSEYEV, S., Moscow

[Abstract] Series K155 combination microcircuits (without internal memory) include simple NAND, AND-NOR, inverter, NOR, AND and OR circuits, as well as more complex elements such as decoders, multiplexers and adders. Pinouts and brief functional descriptions of a number of devices in the series are presented. Figures 22. [205-6508]

UDC [551.594.221.621.315.1].001.4

SELECTIVE SUSCEPTIBILITY OF GROUND SURFACE AND OVERHEAD TRANSMISSION LINES TO LIGHTNING STROKES

Moscow ELEKTRICHESTVO in Russian No 5, May 82 (manuscript received 24 Oct 80)
pp 44-46

ALIZADE, A. A., BEYDULLAYEV, M. A., VELIYEV, Kh. A. and YURIKOV, P. A.
(deceased)

[Abstract] The susceptibility of overhead transmission lines to lightning strokes has been found to be deterministic rather than random in nature. A typical example are the two lines on both sides of the highway in the Voskresensk rayon of the Kolomensk electrical power distribution network of the Moscow Regional Administration of Power System Management, line 5 being struck often and line 33 never. An experimental study was made to determine whether the susceptibility to lightning strokes depends on the radioactivity and the electrical conductivity of the ground. The distributions of these two parameters were measured with an SRP-68 instrument and an AE-72 instrument, respectively, at various distances between poles. The radioactivity was found to vary almost identically along both lines, but the conductivity profiles under them down to a depth of 25 m were found to differ appreciably. A comparison of the two profiles indicates that a high probability of a lightning striking at a pole is related to the existence of deep vertical conduction channels in the ground underneath a line. This was confirmed by measurements in other locations. Figures 4; references 11: 8 Russian, 3 Western.
[267-2415]

UDC 537.532

TRAJECTORIES OF STREAMERS OF POSITIVE PULSE DISCHARGE

Moscow ELEKTRICHESTVO in Russian No 5, May 82 (manuscript received 14 Oct 80)
pp 64-66

IVANOV, A. V. and LARIONOV, V. P., Moscow Power Engineering Institute

[Abstract] The dependence of streamer trajectories in pulse discharge on the electric field configuration is analyzed on the basis of experimental data and theoretical evaluation. Measurements were made in 100-150 mm long "rod-plate" and "rod-plate with protrusion" interelectrode gaps, the protrusion being a

100 mm long cylinder with spherical tip. The electric field without and with protrusion was calculated by a numerical method. The change of electric field intensity affecting the streamer was determined on this basis. With the aid of vector diagrams, the reorientation of ionization processes due to even small field perturbations of the order of 1 kV/cm ahead of the streamer are explained by the effect of space charge and electrode charge inducing a positive excess charge at the streamer tip. Using high critical values of field perturbation in existing mathematical models of discharge orientation is, accordingly, incorrect. Figures 2; tables 1; references 6: 5 Russian, 1 Western.

[267-2415]

UDC 621.375.8

AMPLITUDE-FREQUENCY CHARACTERISTICS OF MILLIMETER TRAVELING-WAVE MASERS

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 2 Dec 80) pp 776-780

CHERPAK, N. T.

[Abstract] In millimeter masers with a decelerating periodic structure, the form of the amplitude-frequency characteristics (AFC) changes. It becomes more of a plane than in centimeter range amplifiers, with an expanded amplification band. A traveling-wave maser created in the millimeter band on the basis of andalusite (Al_2SiO_5) is analyzed. The device is discussed in two reports (1979/1980) of which N. T. Cherpak (see above) is the principal author. A significant nonuniformity of the static magnetic field is found in the volume of the active crystal because of the relative increase of the volume of the ferrite element in the delay structure. This explains the broadening of the amplification band and a flatter form of the AFC. The author thanks T. A. Smirnov and A. I. Stetsenko for discussion of the work and A. A. Lavrinovich for assistance in measurements. Figures 4; references 8: 6 Russian, 2 Western (1 in translation).

[300-6415]

UDC 681.325.65

THIN-FILM TWO-FREQUENCY LASER LOGIC ELEMENTS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 25, No 5, May 82 (manuscript received 9 Feb 81) pp 83-85

DERYUGIN, L. N., KOLBIN, I. I. and CHEREMISKIN, I. V.

[Abstract] Thin-film two-frequency laser NOT-inverter logic elements with longitudinal quenching were studied experimentally in a configuration with a pair of such inverters on a common corrugated substrate, both 0.03 cm wide. Without a decoupling narrow-band filter, stable quenching was achieved by means of a diaphragm making the quencher element somewhat longer (0.25 cm) than the quenched one (0.2 cm). Radiation from each inverter was transmitted through an optical communication prism to a spectrograph and also onto photographic film. Both wavelength mismatch and quench factor were measured as functions of

the film thickness. With glass-gelatin-air waveguides, a change of film thickness from 0.6 to 1.6 micrometer changed the radiation wavelength by 70 Å. The pumping radiation was polarized with the E-vector perpendicular to the grating lines so that both inverters generated the lowest H- and E- modes. The results indicate the feasibility of quenching one radiation by means of another from a separate source at a much different wavelength. Figures 3; references 6:

5 Russian, 1 Western.

[276-2415]

SOLID STATE CIRCUITS

UDC 621.373.1

ANALYSIS OF CHARACTERISTICS OF FIELD-EFFECT TRANSISTOR WITH FORWARD p-n JUNCTION BIAS BASED ON SMALL SIGNAL EQUIVALENT CIRCUIT

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 26, No 8, Aug 81
(manuscript received 27 Nov 79) pp 1800-1802

BARANOV, L. I., SELISHCHEV, G. V. and YUDOVICH, M. V.

[Abstract] This brief communication is concerned with calculation and analysis of the characteristics of the equivalent circuit of a field-effect transistor with forward bias of the p-n junction in a small signal regime. During solution of the problem a model was used of a device with a step p-n junction and a channel of the n-type. The device is considered in 1973 and 1978 works of which L. I. Baranov (see above) is the principal author. A block diagram is presented of the equivalent circuit of the active region of a field-effect transistor with a forward bias p-n junction. Expressions are obtained which describe the frequency dependence of its current amplification factor. Figures 1; references 9: 8 Russian, 1 Western.
[88-6415]

UDC 621.373.5

OPEN RESONATOR SYSTEM OF SOLID-STATE MILLIMETER-WAVE OSCILLATOR

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 27 Aug 80) pp 27-32

BORODKIN, A. I., SELEZNEV, D. G. and SMORODIN, V. V.

[Abstract] The performance of an open resonator system for solid-state millimeter-wave oscillators is analyzed on the basis of theoretical and experimental data. Calculations are based on a model of such a resonator formed by an infinitely long and wide grating of metal bars with rectangular cross section between two parallel infinitely large metal plates. The natural resonance frequencies of such a structure are determined from the Maxwell field equations for the longitudinal magnetic component expressed in the form of infinite series, with appropriate boundary conditions, and corresponding linear algebraic equations of the second kind for the series coefficients. These equations and the resulting dispersion equation have been solved numerically, for the purpose

of determining the dependence of the natural resonance frequencies on the grating dimensions and their subsequent optimization to yield maximum transmittance and sharpest resonance peak. Also the amplitude distribution of the electric fields in the resonator system has been calculated theoretically, and measured with a probe shifting the oscillator frequency while moving in the resonator space. The agreement is sufficiently close to recommend this method of calculation for design of quasi-optical solid-state oscillators. Figures 5; references: 3 Russian. [93-2415]

UDC 621.373.5

ELECTRICALLY TUNABLE SOLID-STATE MILLIMETER-WAVE OSCILLATORS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 24, No 10, Oct 81 (manuscript received 13 Apr 81) pp 17-24

KOTSERZHINSKIY, B. A., MACHUSSKIY, Ye. A. and TARANENKO, V. P.

[Abstract] An electrically tunable solid-state millimeter-wave oscillator consists essentially of four stages: active element with coupler, adjustable element with coupler, external electrodynamic system and useful load. Frequency tuning can be effected in any one of these stages: in the adjustable element by means of a p-i-n diode, a varactor, or magnetically; in the active element by change in mode of supply or of external synchronization; in the electrodynamic system by change in dielectric permittivity or magnetic permeability; in the load by change in magnitude or phase of the reflection coefficient. The frequency band covered can be narrow (less than 1%) with most of the energy stored in the external electrodynamic system, wide (more than 10%) with most of the energy stored in the adjustable element, or medium (1-10%) with energy stored in both of the same order of magnitude. One basic design problem is matching the low negative resistance (few ohms) of the active element with the high resistance (tens-hundreds of ohms) of the useful load while maintaining the necessary insertion factor in the intermediate stage with the adjustable element. This problem can be solved either by increasing that negative resistance in the parallel-resonance configuration or by decreasing the input resistance to the active element from the external circuit. In the present state of the art most oscillators are built for the long-wave 30-60 GHz range, fewer for the 60-100 GHz range, and none for the short-wave above 100 GHz range. As active elements serve, respectively, avalanche-transit-time (IMPATT) and intervalley-electron-transfer (Gunn effect) diodes in enclosed construction. The trend of further developments is toward extension into the short-wave range, with IMPATT diodes, and toward use of microwave transistors for the long-wave range. Both lumped and distributed semiconductor structures as well as microstriplines and dielectric waveguides are adaptable to circuit integration. Figures 7; tables 1; references 28: 4 Russian, 24 Western (1 in translation). [93-2415]

COMPARATIVE ANALYSIS OF THREE BINARY CODING METHODS FOR COMPLEX SPACE-FREQUENCY FILTERS IN COHERENT OPTICAL PROCESSORS

Kiev ELEKTRONNOYE MODELIROVANIYE in Russian Vol 4, No 1, Jan-Feb 82
(manuscript received 7 Aug 80) pp 51-55

GOLUBKOVA, M. N., MAYOROV, S. A., OCHIN, Ye. F., ROMANOV, Yu. F. and
TROPCHENKO, A. Yu.

[Abstract] Parallel processing of large optical data arrays is feasible with an analog coherent processor, its most important component being a space-frequency filter with the complex transfer function $F(\omega_x, \omega_y) = \alpha(\omega_x, \omega_y) e^{i\varphi(\omega_x, \omega_y)}$.

This transfer function is defined within the region of $N \times N$ square cells and is read discretely at the center of each (r, s) cell as $F(r\Delta\omega, s\Delta\omega) = \alpha_{rs} e^{i\varphi_{rs}(\Delta\omega -$

discretization step). Amplitudes α_{rs} and phases φ_{rs} of the readings can be coded in each corresponding cell, the latter being subdivided into $M \times M$ elements. Three variants of binary coding by the Lohman method (rectangular single-transmission window in opaque background, with area proportional to amplitude of reading and displacement from center of cell proportional to phase of reading) are height coding, width coding and compound width-height coding. The algorithms of each are constructed for even M and odd M respectively, with amplitudes of readings normalized to the 0-1 range. They are compared with respect to number of quantization levels and rms error, the former increasing and the latter decreasing as dimension M increases. Compound width-height coding ensures the largest number of quantization levels and the smallest error at any M , the error being smaller with odd M than with even M . The error is largest in height coding, twice as large as the error in width coding with odd M . Subdividing the cells into more than 16×16 elements for width coding or width and height coding is not expedient, because the error will not significantly be decreased further. Figures 4; references 6: 2 Russian, 4 Western.
[184-2415]

UDC 537.312.62:011.3

INDUCTANCE OF SUPERCONDUCTORS WITH NONLOCAL FIELD AND CURRENT CONNECTION

Moscow RADIOTEKHNIKA I ELEKTRONIKA in Russian Vol 27, No 4, Apr 82
(manuscript received 23 Dec 80) pp 770-775

SPITSYN, A. I., MENDE, F. F. and SKUGAREVSKIY, A. V.

[Abstract] The total inductance of a superconductor is composed of exterior and interior units and depends on the energy of a field stored outside and inside a conductor. In a massive semi-infinite conductor with a nonlocalized connection of the field and current and conductor, the interior inductance L of a single square of the surface at a frequency ω determines the minimum part of the superconductance impedance Z (surface reaction X), i.e., $X = \omega L$. For superconductors with a frequency up to $\omega \sim 10$ GHz and a reduced temperature $t \sim 0.8$ and below, the internal inductance L practically does not depend on frequency. It is determined by the depth of penetration of the static magnetic field λ . In so doing $L = \mu_0 \lambda$. In turn the internal inductance L is composed of two parts, the field inductance L_p and the kinetic inductance L_k . The first is connected with energy which is stored directly in the magnetic field within a conductor, and the second with the kinetic energy of the current carrier. For local massive superconductors of kinetic and field inductance of a single square of the surface equal to one another, $L_p = L_k = \mu_0 \lambda / 2$. A relationship is obtained for L_p and L_k which is accurate for both superconductors and for normal metals. The metal surface on which the electromagnetic radiation falls with a frequency ω is studied. It is shown that the nonlocal effects increase the field internal inductance as compared to the kinetic. These effects will somewhat limit the excess of L_p over L_k for films with $d \sim \lambda$ during transmission of current to them. The authors thank I. O. Kulik for discussion of the results. Figures 2; references 9: 5 Russian, 4 Western.
[300-6415]

CSO: 1860

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